ANATOMICAL PLATES

OF

THE MUSCLES.

EDITED BY JONES QUAIN, M.D.

F.313

Dub pi m.c.

Thomas, John, Eames, Brown

St Thomas's Hospital

October 1st 1848

QAIN and WILSON

[Anatomical plates. Div. I.]

Thos. B. Brown
St Thomas's Hospital

John S. M. Evans.
Penybont.
Llandegley
June 1885.

THE

MUSCLES

OF

THE HUMAN BODY.

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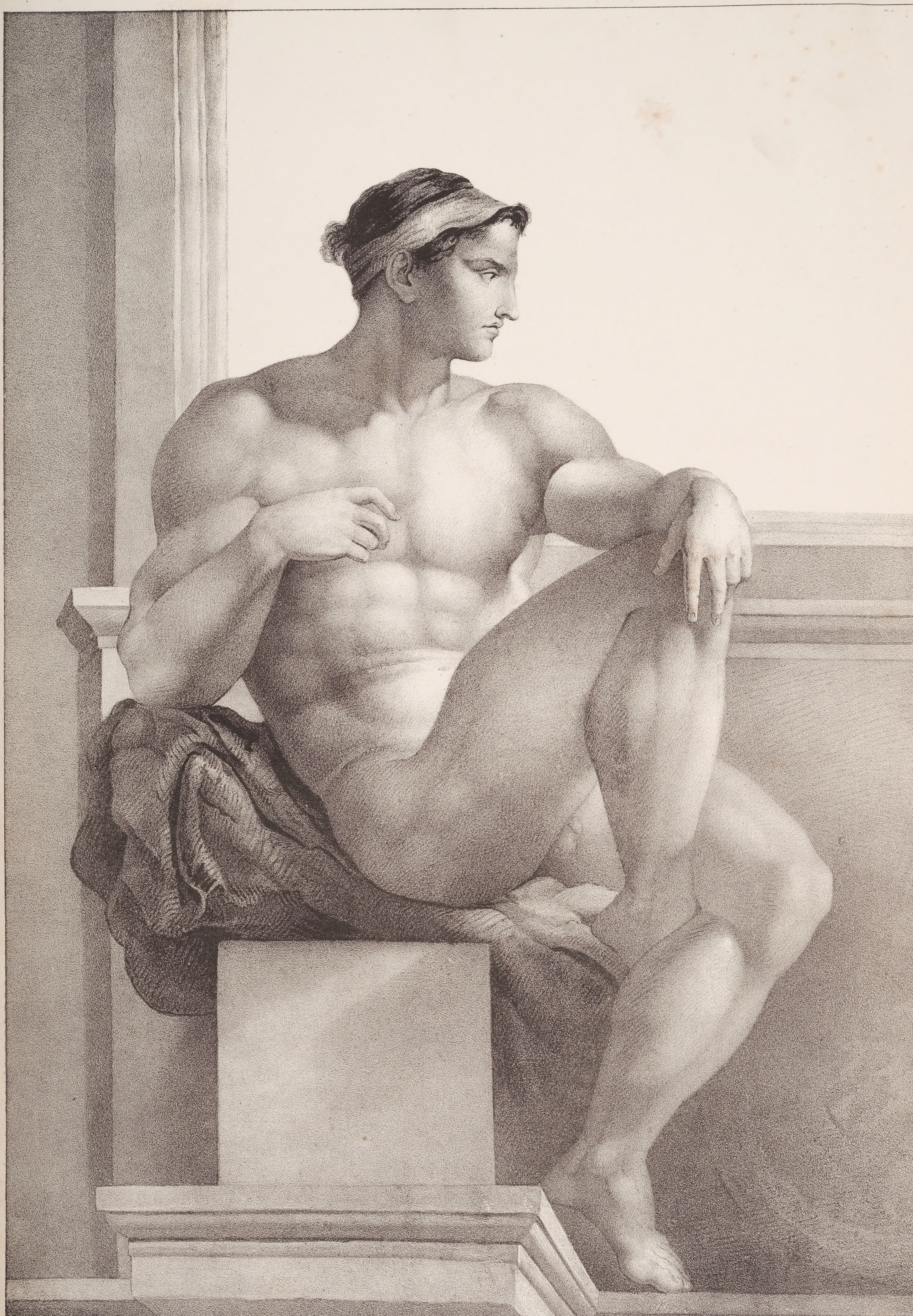

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London, Taylor & Walton, Upper Gower St.

F.313

THE

MUSCLES

OF

THE HUMAN BODY;

IN

A SERIES OF PLATES,

WITH REFERENCES AND PHYSIOLOGICAL COMMENTS.

EDITED BY JONES QUAIN, M.D.

PROFESSOR OF ANATOMY AND PHYSIOLOGY IN THE UNIVERSITY OF LONDON.

LONDON:

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This Publication consists of a Series of the most approved Anatomical Drawings, selected from monograph treatises or from systematic works. The highest place in the former class is deservedly conceded to the works of Scarpa and Tiedemann, and in the latter, to those of Mascagni and Caldani; but from their size, and the style in which they are executed, the expense of publication is necessarily such as to confine their usefulness to comparatively few persons. It may, however, be fairly admitted, that the collections of Cloquet and Loder, though not of equal pretension, are no less valuable to students, as a guide to the knowledge of that complex fabric whose composition they seek to investigate; and to those of maturer age, as a means of reviving impressions received during their earlier studies. As, however, even the works last named from their price are inaccessible to some, and to others from the descriptions and references being given in a foreign language, the want of a similar publication in an English garb has been for some time complained of.

To supply the want here noticed, and at a moderate price, is the object of the present undertaking. The Plates are accompanied by letter-press, containing detailed references to the various objects delineated, the names being set down in English, Latin, and French. But with a view to render them intelligible to a greater number of persons, a running comment on each Plate is given, stating in general terms, and divested (as far as can be) of all technicality, the uses and purposes which the different objects serve in the animal economy. The drawings are taken on stone by Mr. W. Fairland, and the printing executed by Hullmandel, and Graff and Soret.

The Work consists of Five Divisions, as follows:

First.—The Muscles.
Second.—The Heart and Blood Vessels (Arteries and Veins), with the Lymphatic and Lacteal Vessels.
Third.—The Brain and Spinal Marrow; the Nerves and Organs of Sense.
Fourth.—The Organs of Digestion, Respiration, and Secretion.
Fifth.—The Bones and Ligaments.

As the order in which the Divisions appear is of secondary consequence, those are taken first which are most wanted by Students, and which are most interesting in themselves. The number of Plates will be about two hundred and fifty.

THE MUSCLES

OF

THE HUMAN BODY.

The muscles of the body are the agents by which its different efforts and movements are performed. In ordinary language they are known by the name flesh, and as such they differ considerably in colour and consistence in different classes of animals. A muscle is a compound structure made up of cellular tissue for its basis, which encloses in its areolæ fibrine as the essential constituent. Tendinous fibres are superadded in most muscles, particularly at their extremities, forming the means of attachment to the periosteum and the bones.

When we look at a muscle dissected, it evidently appears made up of fibres arranged in a defined direction; several of these are observed to be aggregated into bundles (fasciculi), each of which is detached from the rest by a thin lamella of delicate cellular tissue. Each fasciculus admits again of being separated into fibres, and these into fibrillæ; and the separation may be continued until we at length arrive at some so minute as to be incapable of farther division; these may be regarded, therefore, as ultimate fibres, at least in reference to our methods of analysis.

The muscles thus formed of bundles or groups of fibres, either singly or in various combinations, draw upon the different parts of the skeleton to which they are attached, and put them in motion, or steady and fix them as circumstances may require. As the skeleton, or frame-work of the body, consists of more than two hundred separate pieces, the muscles which move them are proportionally numerous, being about two hundred and twenty pairs. The bones may be considered as so many passive instruments, and the muscles as active agents; for they possess a peculiar property, by virtue of which their fibres contract and shorten themselves in obedience to the will, or on the application of some stimulant. Most muscles are under the direction of the will, which acts upon them through the brain and nerves. Others, however, as the heart, and the muscular coat of the stomach and bowels, are withdrawn from the control of the will, though still they are influenced by and through the nervous system. Hence it is that the former are termed *voluntary*, and the latter *involuntary* muscles, whilst those which are connected with the movements of respiration deserve the name of *mixed* muscles; for though they are subject to our volition, it is only to a limited extent, and they continue their action when the will is suspended, as in sleep.

The nomenclature of muscles is confessedly intricate and confused, owing, in a great measure, to its being the work of different individuals acting without concert, and adopting each a different basis for the construction of the terms employed, so that no scientific or general principle runs through it. Thus the names of some are taken from the mere circumstance of their occurring or appearing in a certain order—first, second, third—taken from a particular point of view. The earlier anatomists adopted this simple plan of naming the different objects, perhaps as they presented themselves in their dissections. But these terms were soon found to be so vague and uncertain, that it became necessary to take into consideration the form of the muscles, and to name them, as far as could be done, from their likeness to particular figures, calling one triangular, another rhomboid, quadrilateral, or pyramidal; and this appeared sufficient for the purpose intended, as far as it went, but comparatively few objects could be brought within its limit. When anatomists began to understand the powers and uses of the different muscles, they naturally sought to name them from a consideration of their actions, calling some flexors, others extensors,—some adductors, others abductors;—and lastly, we find some muscles named from the direction of their fibres—orbicular, transverse, oblique, or ascending; and not a few from the points to which their ends are attached, ex. gr. sterno-mastoid, sterno-hyoid.

Muscles seldom act singly,—two or more usually conspire to execute movements apparently simple. Those which act together are called associates; and when one group habitually reverses the action of another, they are called antagonists. The muscles seen on the fore-arm, and which, by several tendons or white cords, are prolonged through the palm of the hand to the bones of the fingers, curve or bend the joints of the latter, and are therefore named flexors; whilst those at the back part straighten or extend them, and are called extensors. Whilst either of these motions is being executed, it might be supposed that only one group of muscles, ex. gr. the flexors, is in action, the extensors being quiescent: but this is not exactly the case; for when we desire to bend the fore-arm, the will directs through the nerves, towards the flexor muscles placed upon the fore-part of the upper arm (and where they are readily felt as they come into action), a sufficient quantity of nervous influence to enable them to move the limb from point to point, through the arch of a circle, which it describes in passing from the straight to the bent position. Now, during the progress of this motion, the extensors also are kept in a state of tension, though in a less degree; for they are made to give way just so many points as the action of the flexors requires, yet still to hold on so as to moderate it, and at the same time give steadiness to the whole limb.

By referring to plates XLIX. and L. each of the long muscles will be found attached by its extremities to particular points of the bones. The upper end is that by which they most usually hold fast while they pull on the lower; hence the latter point is technically called the point of insertion, the former of origin. This line of action, however, is very often reversed. For instance, in the standing posture, a continued effort is required to keep the leg erect upon the foot; and to effect this, the muscles on the fore-part of the limb take their fixed points below, upon the back of the foot and toes, from which they draw upon the bones of the leg, so as to hold them forward and retain them erect upon the arch of the foot.

How easy and simple a movement that appears to be by which we rise from the sitting posture and assume the erect attitude! and yet it is executed by a series of efforts, requiring the co-operation of a great many muscles, and this, too, after a preparatory movement not a little complex in itself. In the first place, the foot is thrown backwards, and the body inclined forwards, in order to bring the centre of gravity directly over the basis of support: then the flexor muscles in the sole of the foot draw on the toes, and press them against the floor, so as to fix the foot; after which, by a simultaneous effort of several muscles, the leg is made to move backwards, and the thigh forwards, until both become erect. During this change of position, the leg moves through an arch of a circle, whose centre is at the ankle-joint, the bones of the leg representing its radius. As in this case the centre is fixed, the arch described is a part of the circumference of a circle. But the thigh-bone is differently circumstanced; its centre is at the knee, and necessarily changes place so as to pass from point to point through the arch *b c*, whilst its change of position is being effected. Hence, if it is considered as a radius, it will tend to describe as many circles as there are points in the arch *b c;* but it will really describe, not a part of a circle, but a curve, indicated by a line drawn through those points of the circumferences of the circles here indicated, which lie along the interval between its previous position *d*, and its present one *e*. If from *d* a line be drawn obliquely forwards, so as to represent the position of the body during the preparatory movement, it will be evident that the spine also resembles a radius attached to a moving centre at the hip-joint, and that the head, as it is ascending, will move in a curved line, similar to that here indicated, but described in the opposite direction.

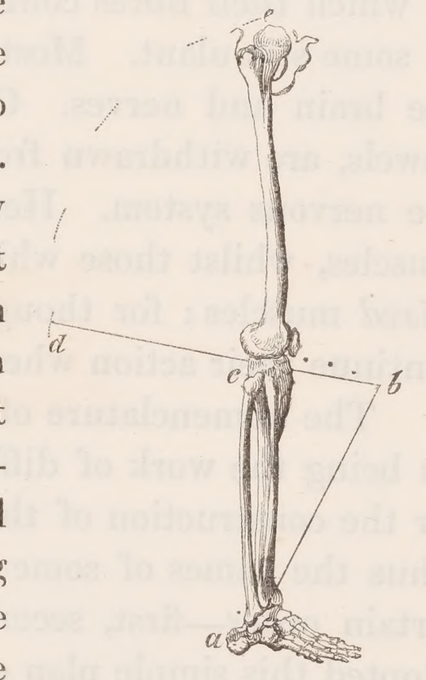

Plate II. is intended to exhibit the intimate composition of muscle, with a view to explain the theory of its action. Fig. 1, 2, 3, are taken from the plate which accompanies the Memoir on Muscular Action, by MM. Prevost and Dumas, (Journal de Physiologie, tom. iii.) Fig. 4, 5, 6, and 7 are drawn from preparations in the Museum of the University. Each muscle, however simple its action may be, is in itself a compound structure: it has arteries, which convey to it blood for its growth and nutrition,—veins, which return the residue of the blood,—nerves, forming cords of communication with the brain, or spinal marrow,—and absorbing vessels, which perform an important part in the different changes which the process of growth and nutrition require. All these are held together by a delicate animal substance, called cellular tissue, which also forms their bond of connexion with the

proper fibres of the muscle. Fig. 4 and 7 represent back and front views of the flexor muscle of the arm. The muscular, or fleshy part, forms a tapering body, from which white tendons, or cords, pass upwards over the shoulder-joint to the blade-bone, or scapula, and downwards over the elbow, to the bone of the fore-arm: it is called biceps, from having two heads, or extremities, at its upper end; between these the nerve is seen branching off into filaments amongst the muscular fibres. In fig. 5 the fibres run obliquely into one side of a tendon, upon which they act like so many cords attached to a rope passing over a pulley. In fig. 6 they are placed at both sides of the tendon, like the fibrillæ on a quill-feather. If the dark lines in the drawings were coloured red, so as to resemble flesh, the tendons at the end being made of a pearl white, they would represent, as nearly as may be, the muscles in their natural condition. When by an act of the will, propagated along the nerve, a muscle, —the biceps, for instance, (fig. 4)—is put in action, its body shortens and swells, its ends are brought nearer, and the fore-arm is drawn upwards into the bent position. This can be felt and seen whilst the effort is being made. It will very naturally be asked, what is the change of state which occurs in a muscle whilst thus passing from repose into action, and what produces the change? Many expedients have been resorted to, and many efforts have been made at different times, to determine these points; but the best conducted and most recent researches are those of MM. Prevost and Dumas (Journal de Physiologie, tom. iii.); yet even these are far from conclusive. A thin, flat muscle, (rectus abdominis,) taken from a frog, and placed under the object-glass of a microscope, appears to consist of fibres cylindrical in their form, and straight whilst in the quiescent state, fig. 1; but when they are irritated, or acted on by electricity, they are thrown into waving, zig-zag lines, and necessarily shortened. By frequently repeating this observation, it is found that the angles, or points of inflexion, always occur at those places in which the muscular fibres are crossed by nervous filaments, (fig. 3.) Here a new question arises—what is the relation which subsists between the nerve and the muscle? When a nerve is traced into a muscle, it gives off delicate branches, most of which pass across the muscular fibres; but they soon become so small as to escape our unassisted vision, particularly in the large muscles of the higher animals, (fig. 7.) But when with the aid of a microscope, as in the experiment already noticed, the muscle of one of the lower animals—for instance, the frog—is examined, nervous filaments will be found at first running between the muscular fibres, and at intervals giving off filaments, which pass across them, and finally returning back in the form of loops, or joining with a neighbouring branch, (fig. 2.) Most nerves convey two endowments, the power of motion and sensation; or rather, they are the means of imparting to muscles, not only the impulse which determines motion, but also of carrying back from them intimations of their condition and of their various changes of state. The former of these is effected by nervous filaments connected with the fore-part of the spinal marrow, and the latter by those attached to the back part; for it has been fully proved, that the power of motion is lost when the anterior roots of the nerves, or the corresponding part of the medulla, is injured, and that sensation is destroyed if the like happens to the posterior. The nerves then as chordæ internunciæ may be likened to conductors, along which an influence flows from the brain and spinal marrow to the muscles, determining their contraction, and in the opposite direction from the muscles to the brain, conveying impressions and exciting sensations. So far we can proceed securely enough; but a step farther leads at once into the region of hypothesis, where our only guide is a forced and questionable analogy. Observation, as above stated, having shown that when a muscle is irritated, its fibres are thrown into zig-zag lines, the angles of inflexion being at the points where they are crossed by the nervous filaments, and the experiments of M. Ampere having determined the fact, that two parallel wires will approach one another when voltaic currents pass along them in the same direction, Prevost and Dumas place these two pieces of information together, and found upon them a rationale of muscular action:—reasoning in this way, that as the wires approach one another when the voltaic agent passes along them, so the transverse filaments of the nerves become approximated when they become the conductors of the nervous influence; and that as they incline towards one another, they ripple and shorten the muscular fibres. It is, however, fairly admitted, that in this mode of viewing the subject, the muscle itself appears to be passive and the nerves alone active.

It may be further added, that as we should not in any case take analogy for identity, so when reasoning on phenomena so widely dissimilar, we are not warranted in rigorously transferring a rule from the one to the other.

We have spoken of the bones as passive instruments; they in fact resemble levers acted on by the muscles, and in the human skeleton we can point out instances of the three orders of levers described by writers on dynamics. When we observe how the base of the skull rests on the spine as its support,

and how the muscles attached to the occiput can raise the face which projects in front, we recognise a lever of the first order, the moving power being at one end, the weight at the other, and the prop between them; again, the leg rests on the foot, and the strong muscles of the calf of the leg are fixed to the heel, so as to raise the body forward on the toes, so that the prop is at one end (the toes), the power at the other, and the weight in the middle,—being an instance of the second sort of lever. Lastly, the muscle (biceps flexor) which runs along the upper arm is fixed into the outer bone of the fore-arm a little below the bend of the elbow, so as to act on the fore-arm and draw it into the bent position. In this case, the weight or resistance (viz. the hand and arm) is at one end, the prop at the other (in the elbow-joint), and the moving power between them, exemplifying the arrangement which obtains in levers of the third order. A loss of power necessarily results from the adoption of this principle, but it is more than compensated by the increased quickness of movement which is acquired.

PLATE I.

Is a figure copied from the fresco painting by Michael-Angelo in the Sistine Chapel, which has been selected for its fine and muscular proportions.

PLATE II.

Fig. 1, gives a magnified view of muscular fibres in the state of repose. The white lines indicate the course of the nerves: as they run along, they give off delicate filaments which cross the fibres of the muscle.

Fig. 2, shows how the ultimate filaments of the nerves are disposed. After branching out for some way, as in Fig. 1, they become curved, and return into themselves, forming loops; or they incline towards a neighbouring branch, and form inverted arches.

Fig. 3, represents the fibres in the state of contraction, when they are thrown into waving zig-zag lines. The transverse nervous filaments will be seen crossing them at the angles of inflexion.

Fig. 4, is a front view of the biceps flexor. Fig. 7, a back view of the same. The branches of the nerve are seen ramifying amongst the muscular fibres.

Fig. 5, is a semi-penniform muscle.

Fig. 6, is a double penniform muscle, the fibres being placed at each side of a central tendon, like the fibrillæ of a quill-feather. In Fig. 5, the fibres are at one side only.

PLATES XLIX. & L.

With which this volume concludes, exhibit the muscles as they are brought into view by the removal of the skin, with the membranous and adipose layers placed beneath it. Back and front views are given, and in each the deeper seated as well as the superficial muscles are shown.

Plate 2.

Fig: 1.

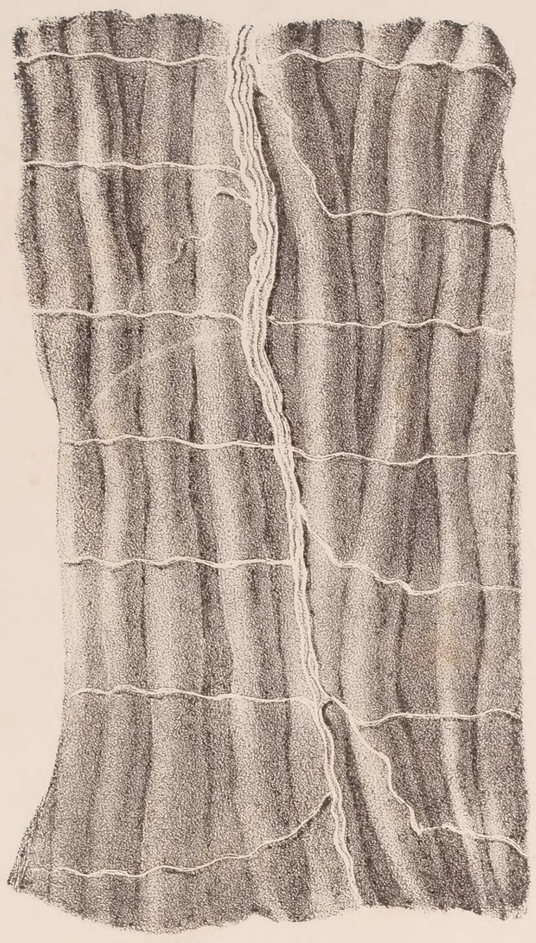

Fig: 2.

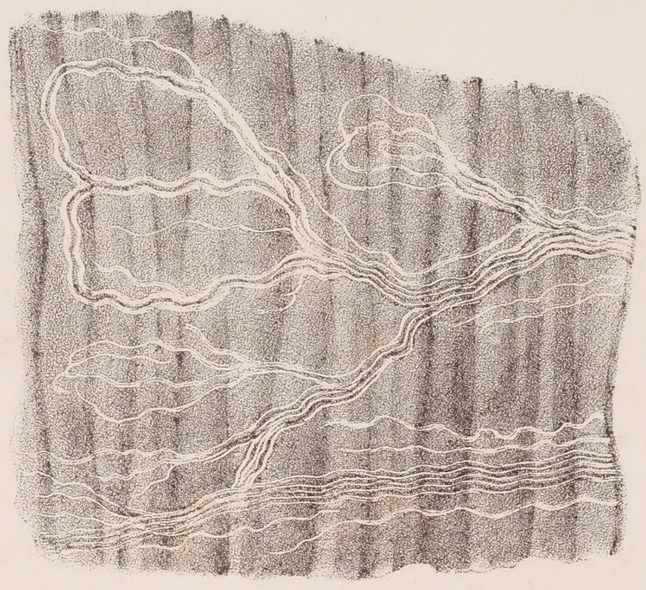

Fig: 3

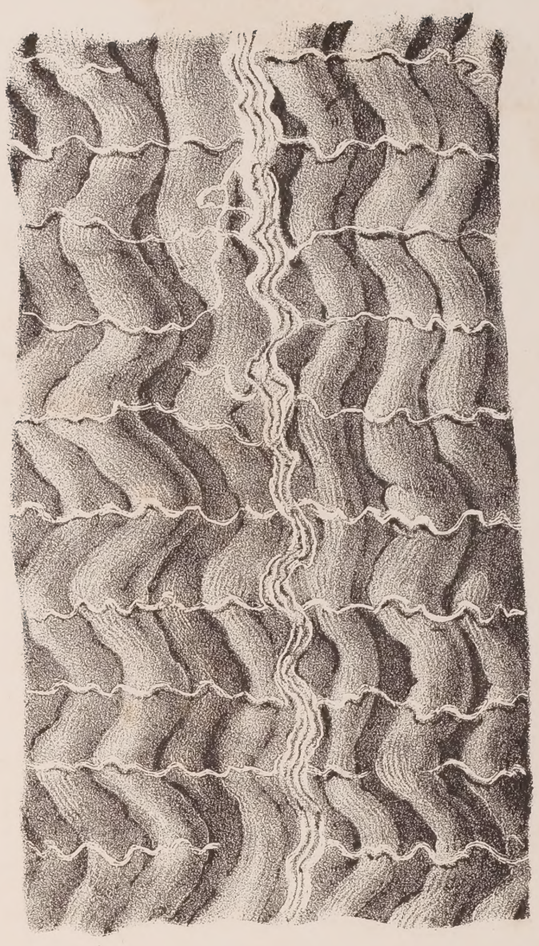

Fig: 4.

Fig: 5.

Fig: 6.

Fig: 7.

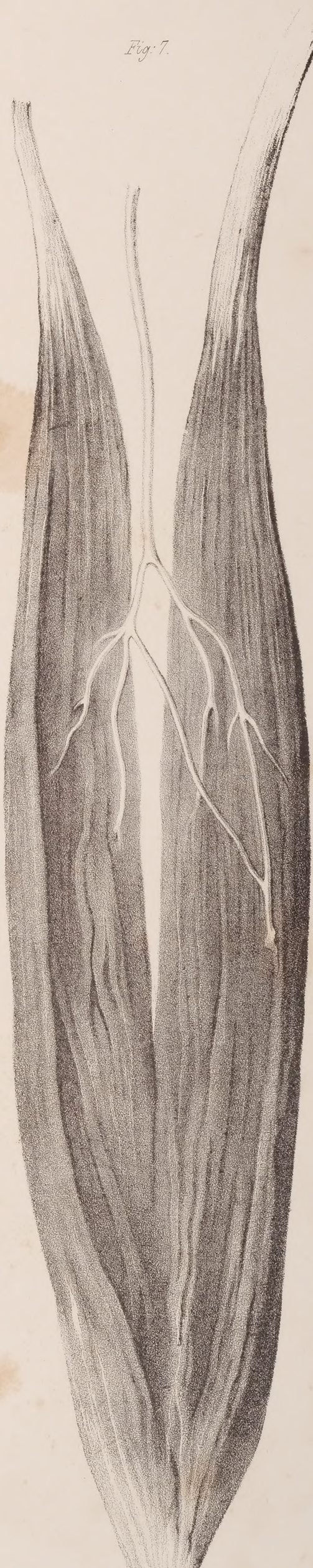

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Plate 3.

Fig. 1.

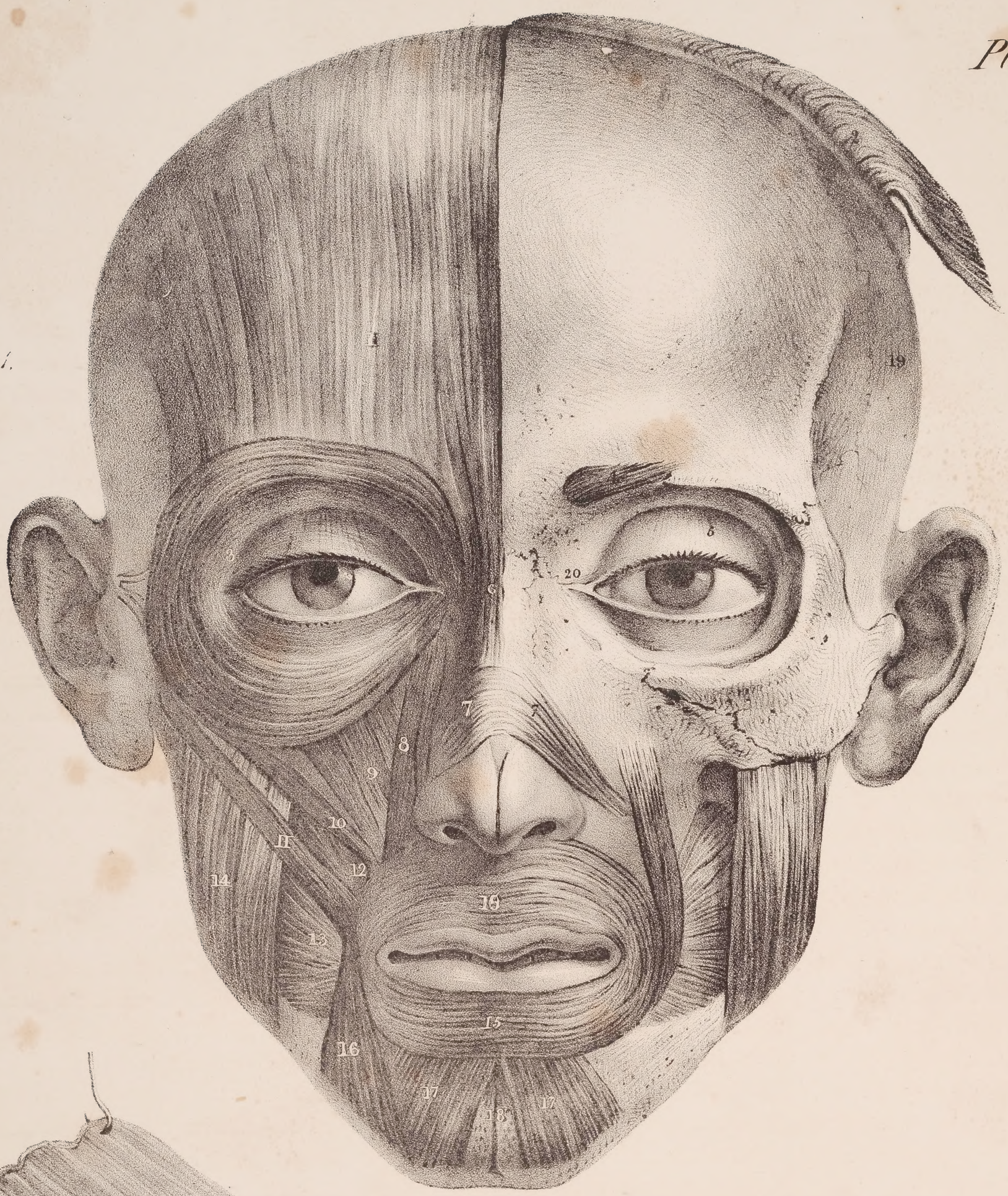

Fig. 2.

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PLATE III.

The first drawing in this plate gives a front view of the muscles of the face, the skin and cellular tissue which lies under it,—and the vessels and nerves being removed in order to show distinctly the direction of the muscular fibres and their points of attachment. At the right side of the face all the muscles are allowed to remain in their natural position; but at the left, some of them are removed so as to bring into view some which would otherwise remain concealed either wholly or in part. No. 1 is reflected obliquely upwards from off the forehead so as to expose No. 4. No. 3 is taken away to show the eye-lids, and their tendon No. 20, as well as the tendon of the muscle which raises the upper lid (levator palpebræ superioris). Nearly the whole length of this muscle is concealed within the orbit; a small part, however, No. 5, projects beyond its margin and is fixed into the cartilage of the upper lid. Nos. 8, 9, 10, and 11 are here also left out, in order to show more distinctly Nos. 7, 12, and 13. The second figure shows the back part of the head, covered by the occipito-frontalis muscle No. 1. Both are taken from Cloquet.

As the two lateral halves of the body are symmetrical, the muscles and other structures at each side of the middle line so perfectly correspond, that such remarks or references as are made with regard to the one will necessarily apply to the other.

Each bundle or layer of fibres, here exhibited and marked with figures, is a muscle or moving power capable of acting in obedience to the will, and, when put into action, of contracting and shortening itself. As all these muscles are in intimate connexion with the skin which rests upon them like a thin covering, they can so act on it as to make it assume various changes dependent on their form and size, on the direction of their fibres, and still more on their acting singly or in combination. Thus No. 1 consists of fibres which run down from the top of the forehead to the eye-brow. They are obviously continuous at their upper ends with a thin tendon, which, in the form of a layer of white membrane, rests upon the arch of the skull, and extends to the back of the head, where by means of muscular fibres it is attached to the curved ridge seen on the bone, on a level with the ear, fig. 2, No. 1. Now, when this muscle is put into action, in the first instance it draws up the eye-brow, and if its effort is carried further it throws the skin of the forehead into transverse folds or wrinkles.

The lower end of these fibres will be observed to be connected along the line of the eye-brow with those of No. 3, and there they conceal a little muscle such as is seen at the left side No. 4; at the root of the nose the fibres of No. 1 are prolonged down for some way, and become attached to the

PLATE III.

Fig. 1. No. 1. The fore-part of the occipito-frontal muscle, (m. epicranius.) 2. The same, detached and everted, so as to expose the bone. 3. The orbicular muscle of the eye-lids, (m. orbicularis palpebrarum; m. orbiculaire des paupières.) 4. The corrugator of the eye-brow, (m. corrugator supercilii; m. sourcilier.) 5. Part of the elevator of the eye-lid seen as it projects beyond the border of the orbit, and descending to be inserted into the cartilage of the lid, (m. levator palpebræ superioris; m. élevateur de la paupière supérieure.) 6. The pyramidal muscle of the nose, (m. pyramidalis nasi; m. fronto-nasal.) It appears like a continuation of the occipito-frontal muscle. 7. The triangular muscle of the nose, (m. compressor nasi; m. sus-maxillo-nasal.) 8. The elevator of the upper lip and wing of the nose, (m. levator labii superioris alæque nasi; m. grand sus-maxillo-labial.) 9. The elevator of the upper lip, (m. levator labii superioris; m. moyen sus-maxillo-labial.) 10. The small zygomatic muscle, (m. zygomaticus minor; m. petit zygomato-labial.) 11. The large zygomatic muscle, (m. zygomaticus major; m. grand zygomato-labial.) 12. The elevator of the angle of the mouth, (m. levator anguli oris; m. caninus; m. petit sus-maxillo-labial.) This is distinctly seen at the left side as it descends from the upper jaw-bone to the angle of the mouth. 13. The buccal or cheek muscle, called also the buccinator or trumpeter's muscle, (m. buccinator; m. alveolo-labial:) it is more distinctly shown at the left side. 14. The masseter muscle, (m. masseter; m. zygomato-maxillaire:) it is one of the elevator muscles of the lower jaw. 15, 15. The orbicular muscle of the mouth, (m. orbicularis oris; m. labial:) its form is properly that of an ellipse, and the two references are used to mark its upper and lower segments. 16. The depressor muscle of the angle of the mouth, (m. depressor anguli oris; m. triangulaire des lèvres.) 17. The depressor of the lower lip, (m. depressor labii inferioris; m. quadratus menti; m. mento-labial.) 18. The elevator of the chin, (m. levator menti.) 19. The bones of the side of the head. 20. The tendon of the eye-lids, and of their orbicular muscle. The muscle is removed to show the tendon and the lids more distinctly.

Fig. 2. Gives a view of the back of the head. The occipito-frontal muscle remains in its natural position at one side, No. 1. At the other it is detached and drawn upwards. 2. The thin aponeurosis, which connects the occipital with the frontal part of the muscle as seen in fig. 1, No. 1, rests upon the skull, and slides smoothly over it. 3. The posterior muscle of the ear, (m. retrahens aurem; m. mastoido-auriculaire.)

bone. To form a clear idea of the form, extent, and structure, of this muscle, just for a moment suppose a piece of wire, or a long needle, to be introduced beneath its inner border, half an inch above the root of the nose, and pushed outwards close to the bone until it protrudes at the temple; and this can be readily done when the parts are dissected, as it merely rests on the bone. Then, by holding the two ends of the wire, it may be made to pass from before backwards, so as to slide under the muscle as far back as the occiput. By this expedient it may be shown that the muscle consists of two fleshy portions connected by a thin tendinous membrane. One fleshy part rests on the forehead, (fig. 1, No. 1,) and the other on the occiput, (fig. 2, No. 1.) All the parts of this muscle are intimately connected with the skin, while they slide smoothly over the skull; and, as the fleshy fibres at its opposite ends can be put alternately in action, we can readily conceive how it is that persons in whom it is much developed can move the hairy scalp, and draw it forwards and backwards at pleasure.

No. 3 is a flat plane of circular or elliptic fibres placed round the eye-lids, but extending at the same time upwards on the brow and downwards on the cheek. Between the upper and lower segments of the muscle is the transverse fissure which separates the eye-lids, and through which the globe of the eye projects. This muscle is not connected with the bones of the face at any point of its extent except towards the inner border of the orbit, where it becomes attached by means of a small white tendon (similar to that seen at the left side No. 20), and also by some of its own fibres, which are fixed a little above the tendon. But the upper part of the muscle which lies along the eye-brow is intimately connected with the fibres of No. 1 which lies above it, and with No. 4 which is placed under cover of it. No. 4, when brought into view by removing No. 3, appears in the form of a small tapering bundle of muscular fibres, attached by its inner end to the bone, whilst the other becomes blended with the two preceding muscles. Now, when No. 3 is thrown slightly into action, it contracts and shortens in such a way that the fibres of the upper and lower segments become straight and approach one another so as to close the eye-lids. If this action is continued and becomes forcible, the lids become wrinkled and drawn at the same time inwards to the root of the nose, by which means the tears, and any extraneous matters which may rest upon the eye-ball, are carried to the inner angle of the orbit, whence the lachrymal ducts lead to the nose. If No. 1 raises the brow and wrinkles the skin of the forehead transversely, this muscle can draw it downwards and undo the creases.

Let the reader for a moment conceive that he can lift up this muscle from the parts on which it lies by passing a wire under its external border, where it rests on the cheek-bone, and then gradually detaching the lower segment of it from the bone and the muscles 8, 9. The upper segment may also be separated along the eye-brow, although with more difficulty, as it is connected intimately with No. 1. If a piece of card be then placed under it, it will represent what we have stated it to be: viz. a flat plane of elliptic fibres, which are not connected with the bones of the face at any part of their extent except at the inner border of the orbit. At this point will be observed a small white line, representing a tendon, which runs horizontally outwards from the side of the nose to the fissure of the eye-lids. It is marked at the left side No. 20; it can be readily felt under the skin by drawing the lids outwards, so as to make it tense. To this tendon some of the muscular fibres are attached, and others are connected with the bone higher up towards the root of the nose.

No. 4, by its direction and point of attachment, is enabled to draw the eye-brow inwards, and throw it into vertical folds, as in frowning: but in this action the inner part of the upper segment of No. 3 exerts a considerable influence; for the brow is obviously drawn downwards in the direction of the tendon or fixed point of this muscle, as well as inwards to the root of the nose.

We proceed in the next place to the muscles of the mouth. The transverse fissure between the lips is here observed to be surrounded by a flat plane of elliptic fibres, No. 15, in most respects similar to those of the eye-lids. By a slight degree of contraction they close the lips, and when they act a little more forcibly they crease the skin, and render the aperture small and circular, like the mouth of a purse, when its string is drawn tightly. To this, as to a common centre, several bundles of fibres, forming so many separate muscles, will be observed to converge from different points. Nos. 8 and 9 run downwards from the margin of the orbit; Nos. 10 and 11 incline obliquely from the cheek-bone. No. 13 inwards from the cheeks, Nos. 16 and 17 upwards from the lower jaw-bone. The ends of these muscles which are most distant from the mouth are attached to the bones here named, as to so many fixed points; but the other ends are united to the circular muscle round the mouth. Now all these may be considered as so many retractors, which can draw the lips either upwards, downwards, outwards, or obliquely upwards. If No. 8 acts by itself, it draws up the lip and the wing of the nose, for three or four of its fibres will be seen attached to the most prominent part of the side of the nose. No. 9 draws the middle of the lip also upwards: No. 12 elevates its angle: Nos. 10 and 11 draw the

angle outwards and upwards, whilst 16 depresses it: No. 17 draws down the lower lip. It is by the agency of these different moving powers that the face can exhibit all that variety of expression of which it is susceptible. The forehead and brow, now calm and placid, can instantly be made to assume the frown of aversion or contempt. And the lips which slightly move as we speak, or at times open into a smile, may with the rapidity of thought exhibit all the varieties of expression which characterise joy and grief, hope and despair, the tenderness of affection, or the bitterness of scorn.

The different muscles here noticed receive branches from a nerve (facial), which serves as the means of connecting them with the brain, and placing them under the control of the will. This nerve, after passing down through the base of the skull, lies at first deeply in the interval between the ear and the angle of the jaw, where it soon divides into long filaments, which branch out upon the side of the face, some mounting upwards upon the temple, others inclining down along the lower jaw and the throat, whilst more proceed across to the cheek, nose, and lips. To this nervous cord and its branches, the muscles of expression owe their power of action. If it be compressed by a tumour, or divided during the progress of a surgical operation, the muscles become paralyzed, and lose the power of motion and of expression. Whenever this occurs, the muscles of the sound side being no longer counteracted, will draw on the mouth and lips, and cause a permanent deviation. The influence of nervous action upon the muscles is thus rendered obvious. Now, as the expressions of the face are put on in obedience to the promptings of the will, or the impulse of passion, they form so many outward indications of inward feeling; and as in many instances they are so often repeated as to become habitual, they give a certain cast to the countenance indicative of the prevailing habits of the mind.

In the features of an empassioned countenance, (observes Sir C. Bell, Anatomy of Expression,) it is not upon a single feature that the emotion operates,—there is a consent and accordance between different parts,—the whole face is marked with expression, and all its movements are consentaneous. "Hence when the angles of the mouth are depressed in grief, the eye-brows are not elevated at the outer angles, as in laughter. When a smile plays around the mouth, or the cheek is elevated in laughter, the brows are not ruffled, as in grief. The character of such opposite passions are so distinct that they cannot be combined, where there is true and genuine emotion. When we see them united by those who can, at will, control the actions of their muscles, the expression is farcical and ludicrous."

PLATE IV.

The fourth plate gives a view of the muscles which lie immediately beneath the skin, upon the front and side of the neck. To render these apparent, the tegument and the superficial fascia are removed, and the cellular tissue which fills the interstices between the muscles is dissected out; moreover, the deep or proper cervical fascia is taken away, in order to exhibit the form and size of the different muscles, as well as the direction of their fibres.

In fig. 1, a broad but very thin layer of pale fibres, No. 4, will be observed to run up from the top of the chest and front of the shoulder, over the clavicle, and along the side of the neck, to the lower jaw and the cheek. From the paleness and thinness of its fibres, it is evident that its power is very little in the human subject; it may be considered a rudiment of the extensive fleshy layer which lies under the skin in lower animals, and enables them to move it to and fro, as well as to wrinkle it, and thereby remove any irritating substances which may rest upon it. It is called *platisma myoides*—the broad muscle-like lamella (μυων a muscle, ειδος like). Underneath this, and partly concealed by it, the extremities alone being uncovered, is a long, thick (and towards the middle, rounded) muscle, which lies obliquely along the neck at each side, being stretched from the sternum and clavicle, (the breast-bone, and collar-bone,) up to the bony prominence the mastoïd or nipple-shaped process, (μαστος a nipple, ειδος like,) behind the ear. Its name expresses its three points of attachment, viz. sterno-cleido-mastoïd. Its lower end consists of two parts, differing in their form as they do in the parts to which they are fixed; one being rounded and cord-like, the other flat and somewhat triangular; the former arises from the sternum, the latter from the clavicle. These are at first separated by a slight interval filled by cellular tissue, but they soon become united. The two muscles of this name will be observed to be close together at their lower ends, fig. 1, No. 3, and widely apart at the upper ends, where they are fixed to the base of the skull. When they both act together they bow the head, by drawing it downwards and forwards towards the chest, which is the point from which they act; if one of them acts by itself, it draws the head downwards to its own side, but it is also enabled by the obliquity of its direction to give a horizontal movement to the base of the skull, so as to turn the chin round towards the shoulder of the opposite side. Thus the right

sterno-mastoïd muscle, fig. 1, No. 13, can rotate the head, and turn the chin to the left side, until it comes into the position seen in fig. 2.

Two flat, ribbon-shaped muscles are here shown, No. 15, lying beside one another, at the front and side of the windpipe, 27, and organ of voice (larynx,) No. 23. They stretch upwards from the sternum (its inner surface) to the tongue-bone, (os linguale, also called hyoïdes, or U-shaped, from some likeness to the Greek letter *υ*. Hence they are named sterno-hyoïd muscles. Their action is obvious; they draw down the base of the tongue, and are therefore the antagonists of the muscles, which, by being stretched from the lower jaw to the tongue-bone, are so many elevators, (22, 23.) Close to the outer border of 15 is another flat, but still narrower band, 14; part of it is seen running obliquely up from behind 16, to the tongue-bone; part is concealed by 16, and another part, marked 13, lies still lower down, where it is deeply seated, and runs behind the clavicle to the upper border of the scapula, or blade-bone; it is named omo-hyoïdeus, (*ωμος* the shoulder:) it too is a depressor of the tongue-bone. At the external border of 14, and partly concealed by it, is a short, flat muscle, which extends from the side of the thyroïd cartilage, (24,) to the side of the tongue-bone; its name expresses its attachments—thyro-hyoïd. It draws down the root of the tongue, if the thyroïd cartilage is previously fixed, or it will carry the latter upwards, when the tongue-bone is drawn up by the action of the muscles, which connect it with the lower jaw and the base of the skull.

We shall, by and by, see the importance of this movement during the effort of swallowing: it will be found that it draws the entrance into the air-passages upwards, in such a way as to place it securely under the protection of a valve, or coverlid, (the epiglottis,) which prevents the descent of food or fluids into it. Part of a muscle is here also seen at the outer border of the sterno-hyoïd, by which it is overlapped; it comes up from the sternum, and is fixed to the side of the thyroïd, or shield-shaped cartilage, (*θυρον* a shield,) which it draws down if previously elevated.

Beneath the lower jaw are seen three muscles, which differ in form and size, as well as in the direction of their fibres. Two of them incline down from the base of the skull to the tongue-bone. In fig. 2, they appear deeply placed behind the angle of the jaw. One of them, fig. 2, No. 18, is round and tapering; its upper end is attached to a long bony process, which from some resemblance to the ancient stylus,

PLATE IV.

Fig. 1, exhibits the muscles seen upon the front of the neck, after the skin and fascia have been removed. No. 1, the border of the lower jaw-bone seen in front. 2. The clavicle of the right side; that of the left is partly concealed by the platisma muscle. 3. The sternum. 4. The platisma myoides muscle, (musculus latissimus colli; m. peaucier.) 5. The elevator muscle of the chin, (m. levator menti.) 6. The depressor of the lower lip, (m. quadratus menti; m. mento-labial.) 7. The depressor of the angle of the mouth, (m. triangularis oris.) 8. The buccinator muscle, (m. buccinator; alveolo-labial.) 9. The masseter, (m. masseter; zygomato-maxillaire.) 10. The sterno-cleido-mastoid muscle. 12. Part of the trapezius muscle, (m. cucullaris; occipito-dorsi-sus-acromien.) 13. The lower part of the omo-hyoideus muscle, (m. scapulo-hyoideus.) 14. The upper part of the same muscle, the intervening portion being concealed by the sterno-cleido-mastoid. 15. The sterno-hyoid muscle, (m. sterno-hyoideus.) 16. The tongue-bone, (os hyoides; os linguale.) 17. The thyro-hyoid muscle, (m. thyro-hyoideus.) 18. The large wing, (cornu,) of the hyoid bone. 19. Part of the stylo-hyoid muscle. 20. The posterior part of the digastric muscle, (m. digastricus; m. mastoido-mentale.) 21. The anterior part or belly of the same muscle. 22, 22. The mylo-hyoid muscles of the opposite sides, (m. mylo-hyoideus;) their fibres are seen converging, so as to form a seam by their junction, along the interval between the chin and the hyoid bone. 23. The shield-shaped, or thyroid cartilage, (*θυρον* a shield, *ειδος* like,) forming the most prominent part of the organ of voice. 24. The cricoid, or ring-shaped cartilage, (*κιρκος* a circle,) which forms also a part of the organ of voice. 25. A small plate of membrane, (crico-thyroid,) connecting the two parts last named. 26. The thyroid gland. 27. The windpipe or trachea. 28. The inter-clavicular ligament, a strong band stretched across the top of the sternum from one clavicle to the other. 29. Part of the great pectoral muscle. 30. Part of the deltoid muscle.

Fig. 2. Shows the muscles upon the side and front of the neck; the cutaneous or platisma muscle, together with the integument, have been taken away. No. 1. The occipital bone. 2. The mastoid or nipple-shaped process of the temporal bone, in great part concealed by the insertion of the sterno-cleido-mastoid muscle. 3. The tube of the ear. 4. The angle of the lower jaw-bone. 5. The symphysis or junction of the same bone. 6. The clavicle. 7. The sterno-cleido-mastoid muscle. 8. Its clavicular part or origin. 9. Part of the trapezius muscle. 10. The splenius muscle (m. splenius colli et capitis; m. cervico-mastoide et dorso-trachelien.) 11. Part of the elevator of the scapula (m. levator anguli scapulæ; m. trachelo-anguli-scapulaire.) 12. The posterior scalenus muscle. 13. The lower part of the omo-hyoid muscle. 14. The upper part of the same muscle. 15. The sterno-hyoid muscle. 16. The thyro-hyoid muscle. 17. Part of the sterno-thyroid muscle. 18. The stylo-hyoid muscle. 19, 20. The two parts or bellies of the digastric muscle. 21. Some tendinous fibres which connect it to the hyoid bone. 22. The mylo-hyoid muscle. 23. The hyoid or lingual bone. 24. The thyroid cartilage. 25. The thyroid gland. 26. The trachea or windpipe. 27. The inter-clavicular ligament. 28. Part of the great pectoral muscle. 29. Part of the deltoid muscle.

Plate 4

Fig. 1.

Fig. 2.

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Plate 5

Fig. 1.

Fig. 2.

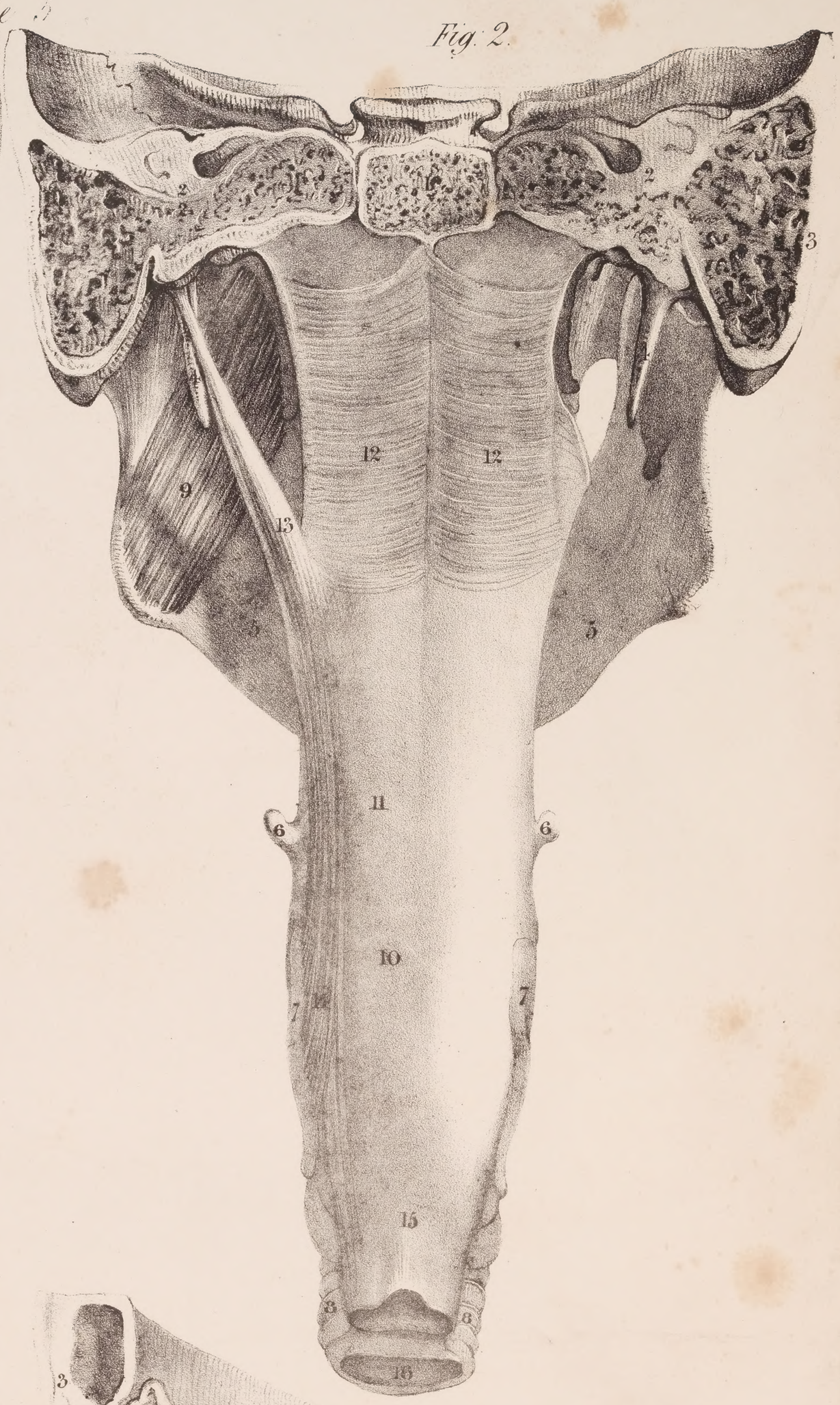


Fig. 3.

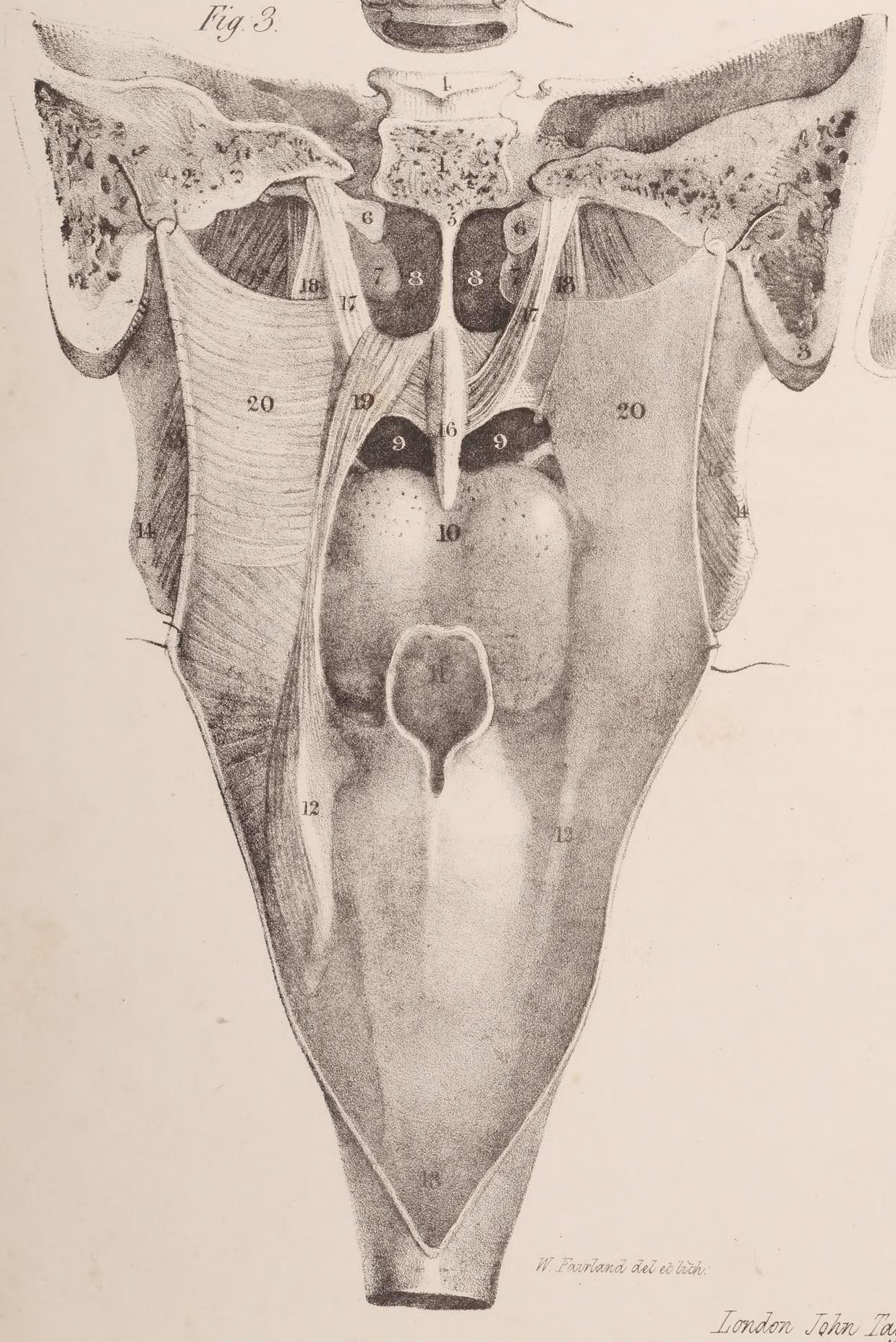
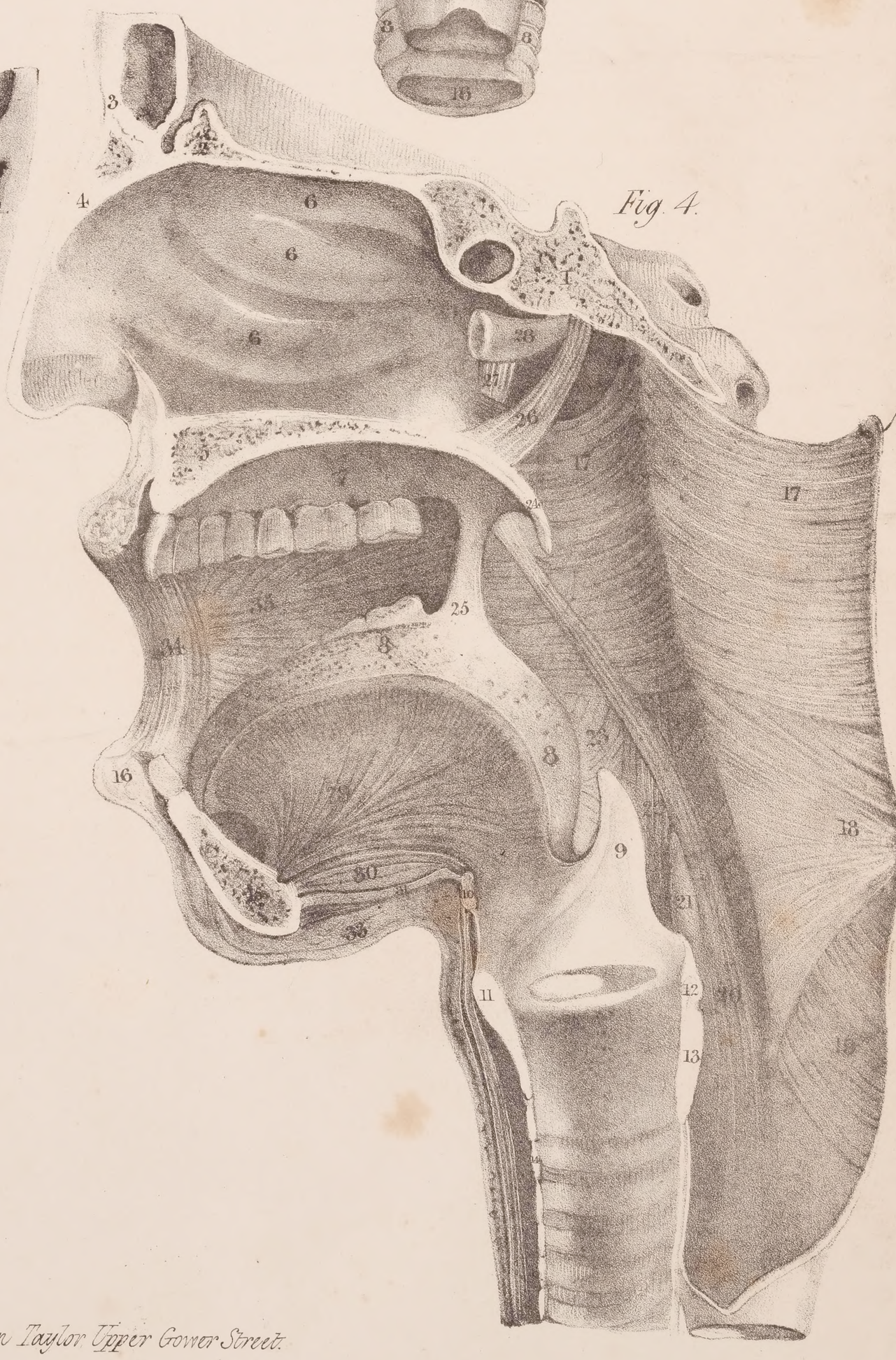


Fig. 4.



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or writing-instrument, has been called "styloid." The lower end of the muscle is fixed to the hyoid bone; hence its name stylo-hyoid. Close to the stylo-hyoid muscle, is one which consists of two parts or bellies united by a round tendon, and which is called digastric or double-bellied. One part, No. 20, is inserted close under the chin; the other lies deeply, being concealed by the sterno-mastoid muscle: the tendon which connects the two runs through a slit in the fibres of the stylo-hyoid muscle, by which means, as well as by some dense white fibres, it is connected with the hyoid bone. The whole muscle thus forms an arch whose concavity looks up to the jaw-bone. Suppose the jaw to be fixed as when the mouth is closed in the preparatory effort of swallowing, and that this muscle is put in action, its fibres when contracted and shortened will bring both its parts from the curved into the straight direction, by which means it will draw up the tongue-bone; the stylo-hyoid muscle will assist in the effort. The anterior part of the digastric muscle is seen to rest upon a flat plane of muscular fibres which pass down from the lower jaw, inclining obliquely inwards as they descend. Close under the chin, the fibres belonging to the muscles of opposite sides meet and join; and this convergence and union takes place along the whole interval between the chin and the tongue-bone, into which the longest fibres are inserted. The upper end of the fibres is fixed to the inside of the jaw-bone, the lower into the tongue-bone; whilst in the interval between the latter and the chin, the fibres converging from opposite sides of the middle line join so as to form a sort of seam (see plate VI. fig. 4). Its name "mylo-hyoid," expresses its points of attachment to a slight ridge at the inner side of the jaw near the grinder teeth (μυλος a grinder) and the hyoid bone. It assists other muscles in drawing up the base of the tongue; and as it is placed immediately under the lining membrane of the mouth, it may be said to form a floor for that cavity, which, by the relaxation of its fibres, permits it to descend and become deep, and by their contraction draws it up again when circumstances require, so as to make it nearly a plane surface.

At the outer border of the sterno-mastoid muscle, fig. 2, Nos. 7, 8, is a deep interval intervening between it and the trapezius, No. 9. In this space will be seen, towards its lower part, the omo-hyoid muscle 13, resting on another, the middle scalenus 12; higher up are the fibres of the splenius and levator scapulæ (Nos. 10, 11). These shall be commented on in a subsequent fasciculus.

PLATE V.

These drawings exhibit different views of the canal or passage which leads from the mouth and nose downwards into the stomach and lungs: it is, in technical language, called the pharynx; it is thin and membranous in its structure, being made up of two layers, the one a mucous membrane continuous with that which lines the mouth and nose, and which is prolonged throughout the whole

PLATE V.

Figs. 1 and 2. Exhibit the pharynx and its muscles, as seen from the back. The arch of the skull is altogether removed, and only a part of its base remains. In order to obtain this view of the pharynx, it must be detached from the spine, in front of which it lies, and the fore-part of the skull must be separated from the back-part, in such a way as to leave the pharynx hanging down from the base of the skull. For this purpose, the trachea and œsophagus must be cut across at the lower part of the neck, near the sternum, and then drawn forwards and upwards; after which there is no difficulty in detaching the pharynx from the muscles in front of the spine, as it is connected with them merely by some loose cellular tissue. In the next place, a piece of linen, or calico, to serve as a retractor and guard to the pharynx, is to be passed down into the narrow interval between it and the top of the spine, and drawn tightly forwards, so as to protect the pharynx. The saw is to be inserted close to the cloth, in such a way that its edge shall rest immediately behind the roots of the styloid processes, and cut through the base of the skull from below upwards. By these means the pharynx, with that part of the base of the skull to which it is attached, is severed from its connexions with all contiguous structures, and can be examined by itself.

One such section will furnish readily the three views seen in figs. 1, 2, 3, and a very little management will suffice to obtain the lateral view given in fig. 4.

Fig. 1. No. 1. Part of the basilar process of the occipital bone. 2, 2. The petrous part of the temporal bone. 3, 3. The mastoid process of each side. 4, 4. The styloid process of each side. 5, 5. The lower jaw-bone. 6, 6. The extremities of the horn-shaped processes of the tongue-bone. 7. The border of the thyroid cartilage. 8. The rings of the windpipe. 9. The internal pterygoid muscles passing down from the groove between the pterygoid processes of the sphenoid bone, to be inserted into the angle of the lower jaw-bone. 10. The inferior constrictor muscle of the pharynx (m. constrictor inferior). At the opposite side the muscle is removed, in order to expose the lower part of the middle constrictor, which it conceals, and also the insertion of the stylo-pharyngeus muscle into the thyroid cartilage. 11. The middle constrictor muscle, its fibres spreading away like the ribs of a fan from their common origin at the tongue-bone, and passing back to unite with the corresponding muscle of the opposite side, and form a raphè, or seam, which is here seen to run from below upwards to the base of the skull. 12, 12. The superior constrictor muscles of each side (m. constrictor superior). The upper border of each is observed to be slightly curved, and as the upper

alimentary canal—the other a layer of muscular fibres, disposed in a very peculiar way, which not only supports the lining membrane, but also gives to the tube itself a contractile power. The pharynx thus formed may be called a musculo-membranous tube; it extends from the centre of the basis of the skull as far as the fifth cervical vertebra, where it terminates in the œsophagus—the lengthened passage which leads thence downwards to the stomach. As the pharynx contracts towards its lower part, it has been likened to a funnel, and the comparison would be sufficiently correct were it not that it is wider in the middle than at its upper extremity: it lies along the neck before the spine, between the great blood-vessels of the neck, and behind the cavities of the nose, of the mouth, and of the larynx or organ of voice, all of which open into it. Figs. 1 and 2 show that it is closed at its back part and sides, in which situation it is found to be but loosely connected with surrounding structures, so that it admits of ascent and descent in the different efforts which are required in swallowing food and drink, and also in modulating the voice. If it be laid open as in fig. 3, by an incision made from below upwards along its back part, then it will be seen that it communicates with the nose by two apertures,—with the mouth by an arched interval situated between the root of the tongue and the palate; also, that two lengthened ducts, called Eustachian tubes, lead outwards from it to the cavities of the ears: that, in the next place, it communicates with the larynx by a narrowed aperture surmounted by a valve called the epiglottis; and finally, that it narrows into a tube as it becomes continuous with the œsophagus. Its connexion with the base of the skull at its upper part is effected not merely by its lining membrane, but also by its muscular fibres, many of which are attached to the bones of the skull, and take their fixed points from them when they are called into action. These muscular fibres are disposed in a very peculiar way at the sides and back part of the pharynx; there are three plates of them at each side, as may be seen in fig. 1, also in plate VI. fig. 1. One plate, situated low down, consists of fibres which are fixed along the side of the larynx, from which they pass obliquely backwards and upwards, until they are met, along the middle line, by a similar set of fibres derived from the opposite side, where they join, forming a sort of seam (raphè); thus they are made to enclose the tube: the lowest of these fibres will

fibres pass from the pterygoid processes to the base of the skull, they necessarily leave a small part of the mucous membrane uncovered. 13, 13. The stylo-pharyngeal muscle of each side (m. stylo-pharyngeus). As the fibres descend they are observed to spread out a little; they become concealed by the middle constrictor, and also by the inferior constrictor; they finally terminate, 14, at the border of the thyroid cartilage. 15. The commencement of the œsophagus, where it passes down from the pharynx.

Fig. 2. Shows nearly the same parts, the inferior and middle constrictor being taken away so as to expose the mucous membrane of the pharynx in the points which correspond with them (10, 11). By these means the stylo-pharyngeus muscle is shown in its entire length, and also the superior constrictor. The stylo-pharyngeus of the right side is also taken away, in order to show the attachment which the superior constrictor has to the inside of the lower jaw-bone, and to the ligament which is extended from that bone to the internal pterygoid plate. No. 1. The basilar process of the occipital bone. 2, 2. The petrous part of the temporal bone. 3, 3. The mastoid process. 4, 4. The styloid process. 5, 5. The lower jaw-bone. 6, 6. The extremity of the horn-shaped process of the tongue-bone. 7, 7. The borders of the thyroid cartilage. 8. The rings of the windpipe. 9. The internal pterygoid muscle of the left side. 12, 12. The superior constrictor muscles of the pharynx; their fibres unite to form a seam along the middle line, and those highest up are fixed into the basilar process. 13. The left stylo-pharyngeus muscle. 14. The insertion of the same into the border of the thyroid cartilage. 15. The tube of the œsophagus, continuous with the lower end of the pharynx, from which it is prolonged down to the stomach. 16. The tube of the windpipe cut across.

Fig. 3. Brings into view the different openings and passages which communicate with the pharynx. This is readily done by laying open the pharynx along its entire length, beginning below at No. 15, fig. 1, and running the blade of a pair of scissors upwards to the basilar process. The sides are then drawn asunder, and retained so by hooks. By these means we see the posterior openings of the nose, 8, 8, with the partition between them, 5. 9, 9. The opening into the mouth, the tongue 10, and the opening 11, into the windpipe and organ of voice. The lining membrane is left on at the right side, but at the left it is removed so as to expose the muscular fibres of the pharynx, 20, and of the soft palate. The muscles of the latter at first appear complex, but their relative position and uses are soon rendered intelligible. The soft palate hangs down from the back part of the roof of the mouth, and is likened to a movable curtain; it presents at the middle a pointed process. 16, called the uvula, and at each side an arched border. Two thin bundles of muscular fibres, 17, 17, run down to it from the base of the skull, which, when put into action, readily draw it up. One at each side, No. 19, descends from it to the pharynx, which can draw it downwards. Another pair, 18, after running for some way vertically downwards, change their direction by coiling round a process of bone, and turn horizontally inwards, by which means they can stretch it from side to side and make it tense. Two little muscles are placed in the uvula, No. 16, which shorten it. In fig. 4, a side view is given of the hard palate, No. 5, and of the soft palate hanging down from its back part, No. 24. (See plate VI. fig. 3.)

Having premised thus much upon the objects of the drawing, we shall now give the references seriatim. No. 1. The basilar process of the occipital bone. 2, 2. The petrous part of the temporal bone. 3, 3. The

be observed to arise from the first rings of the windpipe, and to run almost directly backwards, so as to surround the commencement of the œsophagus, whilst the upper fibres are very oblique in their course, so as to become nearly vertical in their direction, and these will be observed to cross and overlap part of the middle plate. Now the middle plate just mentioned consists of fibres which spread out from a common point, like the ribs of a fan, some upwards, some downwards, the rest with various degrees of obliquity, but all tending towards the back part of the tube, where they unite with similar fibres derived from the opposite side, just as we saw in the case of the preceding muscle. The common point of origin of this muscle is from the side of the tongue-bone (see plate VI. fig. 1); and as they diverge whilst passing backwards, some of them will be observed to get under cover of the inferior constrictor and to be overlapped by it, whilst those placed higher up overlay in their turn the fibres of the superior one. The third or highest of these muscular lamellæ will be observed to embrace the top of the tube; some of its fibres commence at the inside of the lower jaw, some higher up from a thin ligament (pterygo-maxillary, plate VI. fig. 1, No. 20,) which passes from the internal pterygoid plate of the sphenoid bone to the lower jaw, and others still higher from the plate of bone just named. From these different points the fibres pass backwards, coiling round the tube, and join with those of the opposite side, whilst those highest up are fixed into the basis of the skull, forming a slightly-arched border as they curve upwards; this is seen in figs. 1, 2. When these muscles are called into action, they will compress the sides and back part of the tube, thereby diminishing its capacity; hence they are called constrictors of the pharynx, and they are named in their order from above downwards, superior, middle, and inferior; but in describing them and in noting their peculiarities, we begin with that which is lowest down, for it overlaps the middle one, and the latter in its turn overlays that which is still higher up. The attachment of some of the fibres of the superior constrictor to the pterygo-maxillary ligament deserves particular attention, for it shows how the side of the mouth is connected with that of the pharynx, the ligament forming a bond of connexion between the muscular fibres of both. The square muscle which occupies the side of the cheek arises in part from the ligament just alluded to; so that from it, as a common point, the fibres can be traced forwards into the cheek, and backwards into the pharynx (see plate VI. fig. 1, Nos. 18, 20, 24).

mastoid processes. 4. Part of the sphenoid bone. 5. The partition between the right and left cavities of the nose. 6, 6. The extremities of the tubes which lead from the throat outwards, into the cavities of the ears. They are called Eustachian tubes, from the anatomist Eustachius. 7, 7. The extremities of the spongy bones of the nose; these are seen in fig. 4. 6, 6. 8, 8. The posterior openings of the nose. 9, 9. The fauces or narrowed communication from the mouth into the pharynx. 10. The upper surface of the tongue. 11. The epiglottis, and the opening into the air-passage, which it overhangs and protects. 12, 12. The borders of the thyroid cartilage. 13. The tube of the œsophagus or gullet leading down from the pharynx. 14, 14. The angle of the lower jaw-bone. 15, 15. The internal pterygoid muscle. 16. The azygos uvulæ muscle. 17, 17. The elevators of the soft palate. 18, 18. The tensors of the soft palate. 19. The palato-pharyngeus muscle. 20. The superior constrictor muscle everted.

Fig. 4. Exhibits a side view of the parts which are seen from behind in fig. 3. It is obtained by making a vertical section running from before backwards, of the base of the skull, of the roof of the mouth, of the lower jaw, and of the larynx. No. 1. Part of the body of the sphenoid bone, and behind it a part of the basilar process of the occipital bone. 2. The crest or cockscomb process of the ethmoid bone. 3. Part of the frontal bone. 4. The nasal bone. 5. The hard palate or bony roof of the mouth. 6. The three turbinate bones which overhang and form the passages (meatus) of the nose. 7. The inner side of the dental arch. 8. The upper surface of the tongue, and its papillæ. 9. The epiglottis. 10. Part of the tongue-bone. 11. The thyroid cartilage. 12. The arytænoid or ewer-shaped cartilage: between these will be observed an oval depression in the side of the larynx or organ of voice, which represents the ventricle of the larynx; it is bounded above and below by white lines, indicating the position of the vocal cords. 13. Is the back part of the ring-shaped (cricoid) cartilage. 14. The section of the rings of the windpipe. 15. The lower jaw cut through at its fore-part or symphysis. 16. The lower lip. 17, 17. The superior constrictor muscles of the pharynx, that of the left side being held back by a hook. 18. The middle constrictor of the left side everted. 19. The inferior constrictor muscle. 20. The palato-pharyngeus muscle (m. pharyngo-staphylin). 21. The great horn of the thyroid cartilage. 22. The lower part of the stylo-pharyngeus muscle. 23. Part of the middle constrictor muscle of the right side. 24. The soft palate and uvula. 25. The palato-glossus muscle (m. glosso-staphylin) of the right side. 26. The elevator muscle of the soft palate (m. levator palati; m. peri-staphylin interne). 27. Part of the tensor muscle of the soft palate (m. circumflexus vel tensor palati; m. peri-staphylin externe). 28. The Eustachian tube. 29. The genio-hyo-glossus muscle; its name expresses its three attachments: viz. to the inner side of the chin, (γενειον,) to the hyoid or tongue-bone, and to the tongue itself. It is very narrow at its commencement at the chin, but its fibres soon spread out like the ribs of a fan, as they are inserted into the under surface of the tongue from its point as far back as its root. 30. The genio-hyoid muscle; its name expresses its points of attachment to the chin and tongue-bone. 31. The mylo-hyoid muscle. 32. A small part of the digastric muscle. 33. The skin beneath the jaw-bone. 34. Part of the orbicular muscle of the lips. 35. The inner side of the buccinator muscle.

The constrictors are not the only muscular fibres found in the pharynx; two long tapering muscles will be observed to pass down converging into its sides. The upper ends of these muscles are attached to the styloid processes of the temporal bone, and as their fibres descend they get under cover of the middle constrictors, so as to lie between them and the lining membrane; their lower extremities are fixed into the borders of the thyroid cartilage; from their connexions, they are named stylo-pharyngeal. There is another pair of muscles connected with the pharynx of a much smaller size, which can only be seen when the cavity is laid open, as is seen in fig. 3, where a thin fasciculus (No. 19) is seen descending from the side of the soft palate, along the side of the pharynx immediately under cover of the mucous membrane: its name expresses its attachments, viz. palato-pharyngeus.

The muscles here described are the principal agents in deglutition, or swallowing. When a portion of food has been reduced to a pulp, it is collected into a mass upon the surface of the tongue, the tip or point of which is (see plate VI. fig. 2) raised to the roof of the mouth, and then, by a succession of efforts, each part of its surface is pressed upwards against the palate, by which means the food is forced from before backwards, having no other way to escape. In its progress it comes into contact with the depending soft palate, and raises it up, so as to bring it into the horizontal position on a level with the roof of the mouth, or hard palate; when thus placed the soft palate forms a valve which prevents the mass of food from being pushed up towards the nasal cavities, and as it has the power of

PLATE VI.

Fig. 1. Gives a side view of the muscles of the pharynx, showing their different points of attachment to the side of the larynx, to the tongue-bone, to the lower jaw, and to a ligament, No. 20, stretched between the latter and the pterygoid process, 21. The lower jaw is cut across near its angle, and its ascending part or branch removed. No. 1. The side of the skull. 2. The forehead. 3. The cheek-bone. 4. The zygomatic process. 5. The mastoid process. 6. The styloid process. 7. The lower jaw-bone. 8. The upper jaw-bone. 9. The tongue-bone. 10. The thyroid cartilage. 11. The great cornu, or horn-shaped process of the thyroid cartilage. 12. The cricoid, or ring-shaped cartilage. 13. The rings of the windpipe. 14. The commencement of the œsophagus, or gullet. 15. A broad membrane (thyro-hyoid) which connects the thyroid cartilage with the hyoid, or tongue-bone. 16. A round ligament, which connects the cornua of the parts last named. 17. The mylo-hyoid muscle. 18. The buccal, or buccinator muscle. 19. The orbicular muscle of the lips. 20. The pterygo-maxillary ligament. 21. The attachment of the superior constrictor muscle to the inner plate of the pterygoid process. 22. The external plate of the pterygoid process. 23. Part of the circumflex, or tensor muscle of the soft palate. 24. The superior constrictor muscle of the pharynx. 25. The middle constrictor muscle. 26. The inferior constrictor muscle.

Fig. 2. Gives a side view of the tongue and its muscles; also of those which descend from the styloid process to the side of the tongue, to the tongue-bone, and to the thyroid cartilage. No. 1. The side of the skull. 2. The forehead. 3. The cheek-bone. 4. The zygomatic process. 5. The mastoid process. 6. The styloid process. 7. The branch of the lower jaw drawn up. The bone has been cut through at the chin, 7; also at its angle, and part removed, so as to expose the cavity of the mouth. 8. The upper jaw-bone. 9. The tongue-bone. 10. The thyroid cartilage. 11. Its horn-shaped process. 12. The cricoid cartilage. 13. The rings of the windpipe. 14. The œsophagus. 15. The external lateral ligament of the lower jaw-bone. 16. The stylo-maxillary ligament, extended between the styloid process and the angle of the lower jaw-bone. 17. The stylo-hyoid ligament, passing from the styloid process to the small process of the tongue-bone. 18. The stylo-glossus muscle. 19. The stylo-hyoideus muscle. 20. The stylo-pharyngeus muscle. 21. The superior constrictor muscle of the pharynx. 22. Part of the inferior constrictor muscle; the rest having been removed, so as to expose the insertion of the stylo-pharyngeus muscle into the border of the thyroid cartilage. 23. The thyro-hyoideus muscle. 24. The hyo-glossus muscle. 25. The tongue. 26. The genio-hyo-glossus muscle. 27. The genio-hyoideus muscle. The names of these muscles indicate their respective points of attachment.

Fig. 3. Exhibits the muscles of the soft palate, as seen from behind:—the upper jaw-bones, with the roof of the mouth, and a small part of the base of the skull, are retained. No. 1. Part of the basilar process of the occipital bone. 2, 2. The extremity of the petrous portion of the temporal bone. 3, 3. Part of the sphenoid bones. 4, 4. The posterior borders of the upper jaw-bones. 5. The partition between the cavities of the nose. 6, 6. The hook-shaped (hamular) processes of the sphenoid bone. 7, 7. The external pterygoid plates of the same bone. 8, 8. The palate plates of the upper jaw-bones. 9, 9. The Eustachian tubes. 10. The elevator muscle of the soft palate (m. levator palati; peri-staphylin interne), at the right side; that of the left is removed in order to show the entire extent of—11, 11, the tensor or circumflex muscles of the soft palate (tensor vel circumflexus palati; peri-staphylin externe.) 12, 12. The inner or reflected part of these muscles. 13, 13. The muscles of the uvula, (azygos uvulæ; palato-staphylin.) The circumflex muscles will be observed to turn round the hooked processes, which changes their direction, and gives them the mechanical advantage of a pulley, and enables them to stretch the soft palate from side to side and render it tense; the elevator muscles can draw up the soft palate so as to bring it to a level with the roof of the mouth or the hard palate; the little muscles of the uvula draw up and shorten that process.

Fig. 4. Shows the mylo-hyoid muscle which forms the floor of the mouth. No. 1, 1. The inner side of the lower jaw-bone. 2, 2. Its condyles. 3, 3. Its coronoid processes. 4, 4. The mylo-hyoid muscles. 5. The body of the tongue-bone. 6, 6. Its great cornua or processes.

Plate 6.

Fig. 2.

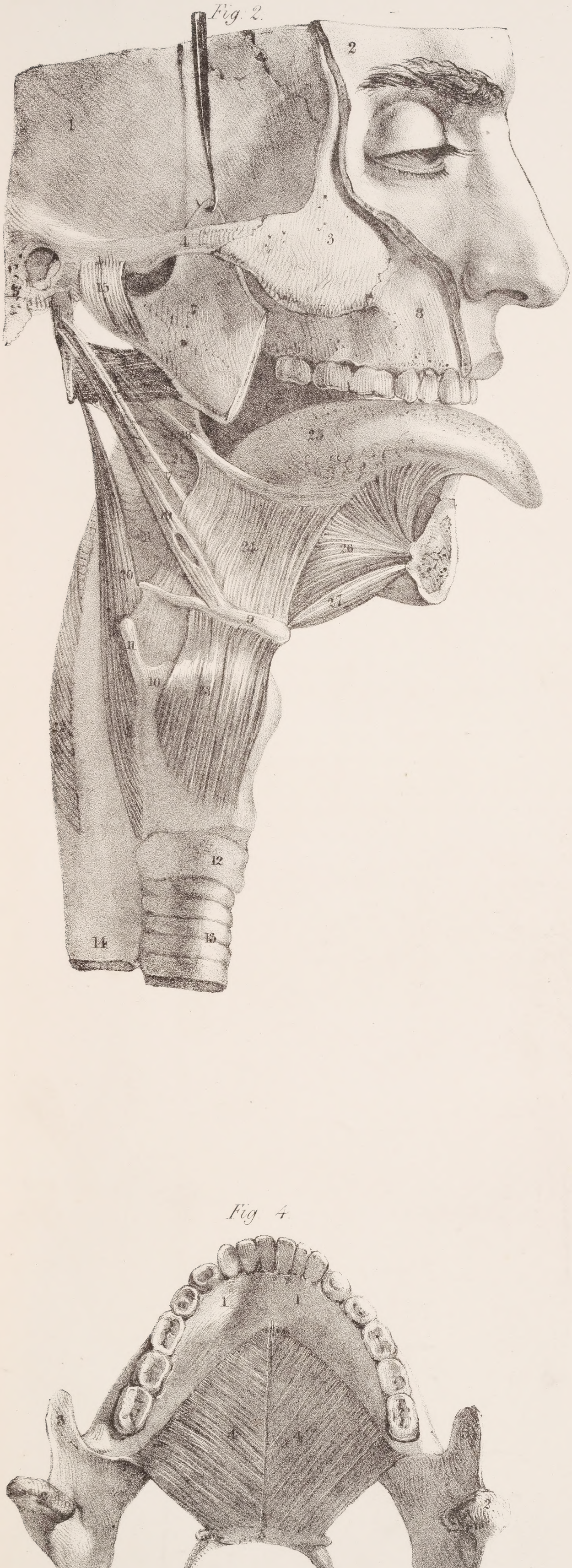

Fig. 1.

Fig. 4.

Fig. 3.

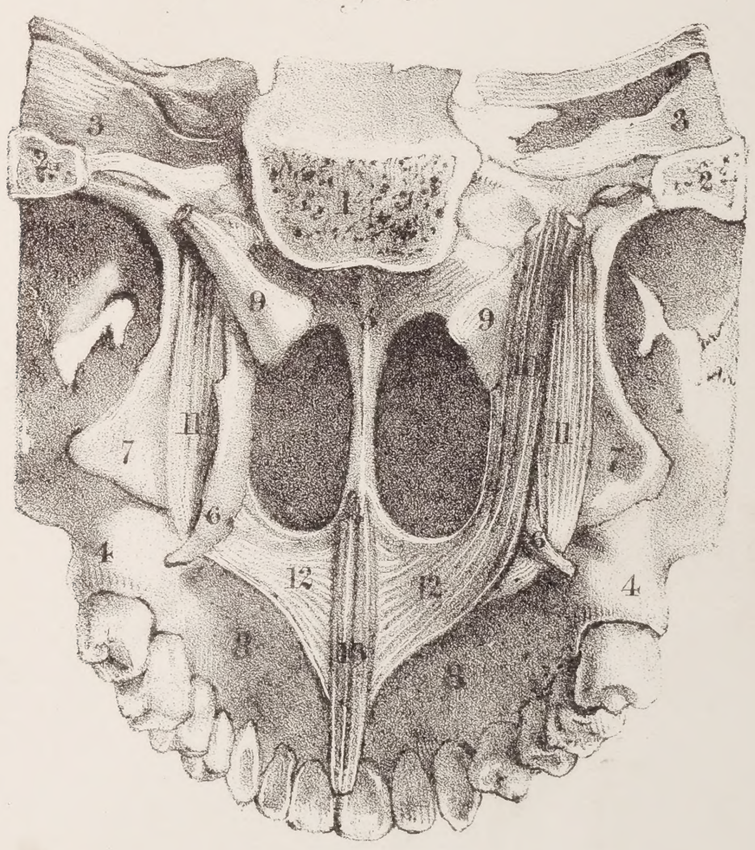

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Plate 7.

Fig.1.

Fig.2.

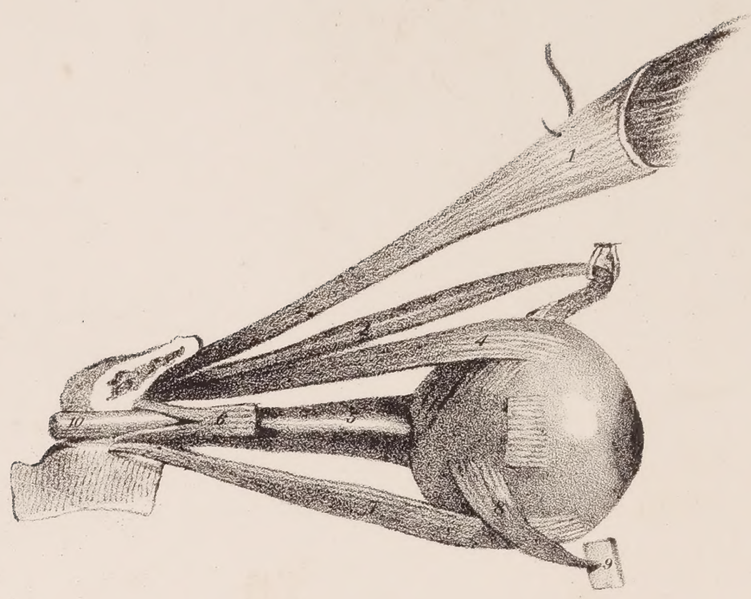

Fig.3.

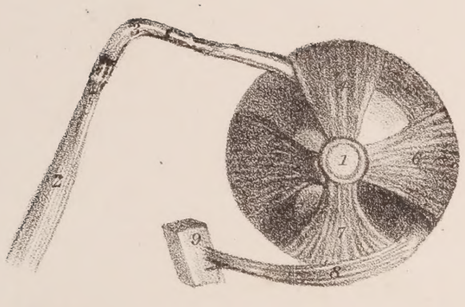

Fig.4.

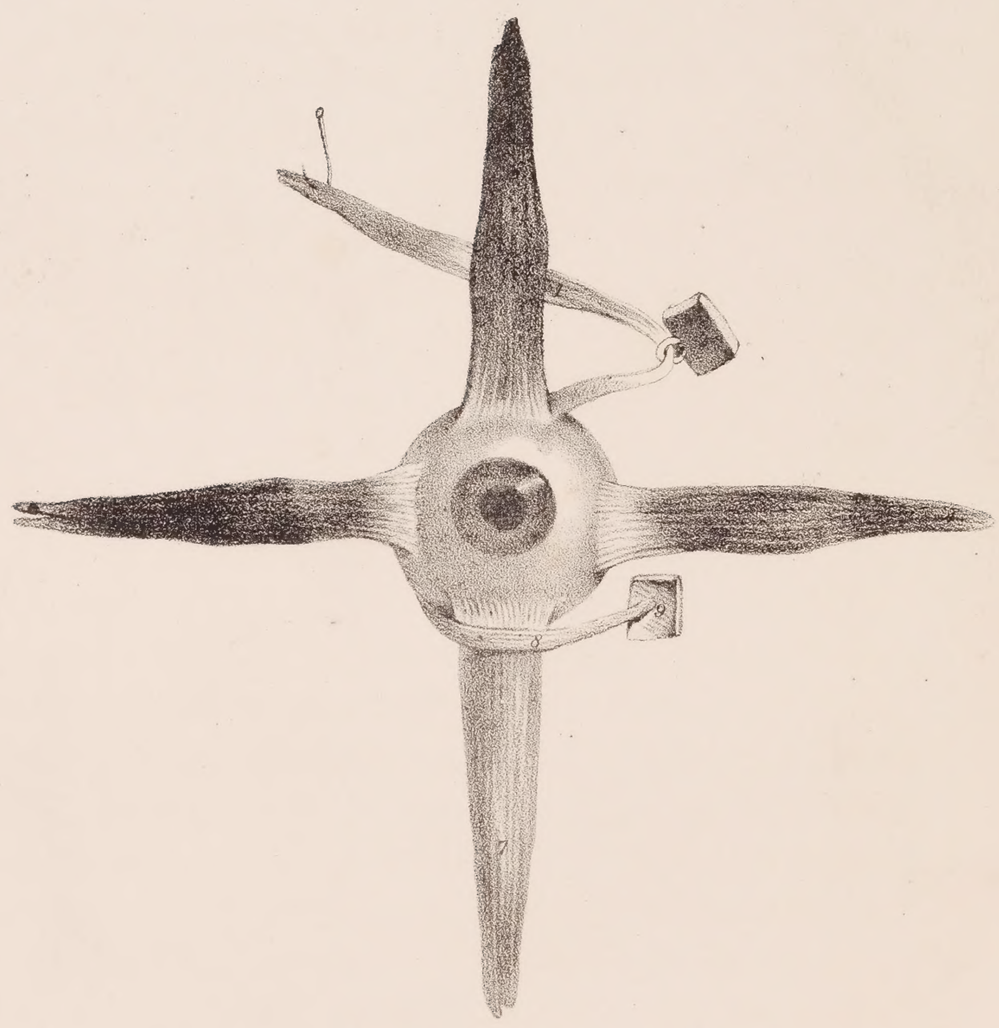

Fig.5.

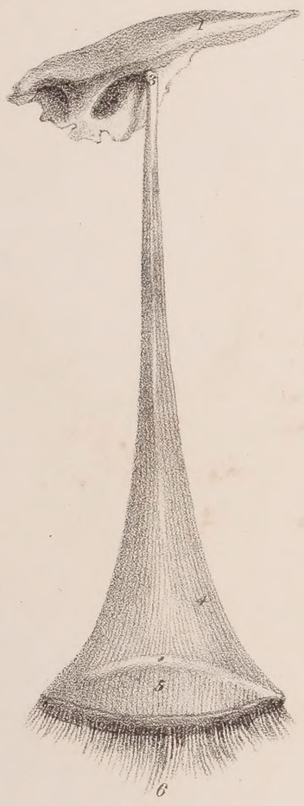

Fig.6.

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contraction within itself, its muscles, particularly the palato-pharyngeal, may even assist in propelling the mass downwards. In swallowing, we are always conscious of a preparatory movement; the mouth is closed by the apposition of the jaws, immediately after which the pharynx is drawn upwards. But this is not the only change which it sustains; it is shortened and widened at the same time. The increase of its breadth from side to side, is effected by the stylo-pharyngei muscles. These, from their points of attachment, are evidently elevators of the pharynx; but the direction of their fibres just as clearly shows, that as they draw it up they will stretch its sides apart, or in other words, widen it, for their points of origin at the styloid processes are farther asunder than their insertions into the sides of the pharynx. Now during this ascent, the tongue-bone and the larynx ascend also; and at the same time are drawn a little forwards, carrying with them the fore part of the pharynx, by which means this tube is prepared for receiving the mass of food which is pressed backwards into it, by the action of the tongue already noticed. As soon as it receives the morsel of food, these muscular efforts cease, the tube descends to its previous position, the fibres of the constrictors begin to act and compress the mass which they surround, forcing it from above downwards into the œsophagus; the upper part of this latter tube being dilated, its circular fibres are stimulated to contract, so as to press the mass onwards in its course, until by a succession of such muscular efforts it is finally conveyed into the stomach. A slight consideration of this mechanism will enable us readily to understand how a mass of food can be made to ascend contrary to its gravity in animals, which feed with their heads to the ground, and how it is kept still in its globular form throughout its passage. The muscular fibres which correspond with its middle, or projecting points, are relaxed, those above it and those below it being in action, so as to keep it for a moment confined;—then the lower fibres are made gradually to give way, as if overcome by the action of the superior ones, and as they relax they will come into apposition with the most projecting part of the mass — that degree of contraction which is necessary for its support and confinement being taken on by the fibres still lower down, so that a state of contraction and relaxation being assumed successively by a series of circular fibres placed along the whole length of the tube, they will sustain and propel its contents, at the same time that they limit the rapidity of its passage, and impress upon it the globular form. Fluids whilst being swallowed are controlled by the same agency; they do not trickle along the canal or run in a stream. In animals which drink with their heads downwards, we see that each portion of fluid which is taken up by the mouth is made to pass along the œsophagus in a globular form, as if it were solid; for the contractile fibres which surround the tube apply themselves to the surface of the fluid so as to grasp it at all points, and retain it in that form; and such is the consent and harmony between them, that they can give way and contract by so nice an adjustment, that they will convey it to its destination in the same form as they received it. It is by calling these muscular powers into action, that a mountebank is enabled to swallow fluids when standing on his head. We have spoken here of the œsophagus and pharynx as being the agents of deglutition; they differ much, however, not merely in form, but in structure; that of the œsophagus being more simple and uniform, as its muscular structure consists of fibres disposed, some in the longitudinal, and others in a circular direction; but in the pharynx they are arranged, as we have seen, in a very different manner, and are also more highly developed, which

PLATE VII.

The muscles which move the globe of the eye.

Fig. 1, is a vertical section of the orbit at the right side, the muscles and the globe of the eye being left in their natural positions. No. 1. The elevator muscle of the upper eyelid, (m. levator palpebræ superioris; m. releveur de la paupière supérieure.) 2. The superior oblique muscle, running through its pulley and reflected (3) backwards and outwards to the globe of the eye, (m. obliquus superior, trochlearis; m. grand oblique.) 4. The superior straight muscle, (m. rectus superior; m. droit supérieur.) 5. Part of the internal straight muscle. 6. The external straight muscle, (m. rectus externus.) 7. The lower straight muscle, (m. rectus inferior.) 8. The inferior oblique muscle, (m. obliquus inferior.) 9. The optic nerve at its entrance into the orbit.

Fig. 2. The same structures as in the preceding, detached from their connexions with the orbit, so as to be more distinctly seen. No. 1. The elevator of the upper eyelid. 2. The superior oblique muscle with its pulley. 3. Its reflected tendon. 4. The superior straight muscle. 5. The internal straight muscle, partly concealed by the optic nerve. 6. The external straight muscle; its origin and insertion are retained, but the middle part is cut away to show the position of the optic nerve. 7. The inferior straight muscle. 8. The inferior oblique muscle. 9. A small piece of the superior maxillary bone from which it arises.

Fig. 3. The globe of the eye and its muscles seen from behind. No. 1. The optic nerve cut across. 2. The superior oblique muscle. 3. A sheath of synovial membrane which surrounds it as it passes through its pulley to facilitate its movements. 4. The superior straight muscle. 5. The internal straight muscle. 6. The external straight muscle. 7. The inferior straight muscle. 8. The inferior oblique muscle. 9. A small piece of the bone from which it arises.

renders it probable, that this part of the canal performs some other functions besides that of receiving and propelling such substances as are to be conveyed into the stomach. It appears to exert an important influence in the modulation of the voice, more particularly in the production of its higher notes; for if the fore-finger and the thumb be placed at the opposite sides of the throat, so as to embrace the tube of the pharynx, and if, at the same time, an effort be made to produce the different notes of the musical scale in the ascending order from the lowest to the highest, it will be found that the sides of the tube, which are at first soft and relaxed, gradually become tense, and finally rigid, when the higher notes are produced.

PLATE VII.

We have here several drawings of the muscles which move the globe of the eye, intended to illustrate their relative positions, their points of attachment, and actions. In fig. 1, the globe of the eye with its muscles is seen from the side, and it is obvious that they do not fill the whole of the orbit or socket in which they are placed; considerable space is left, which is occupied by arteries, veins, and nerves, and a large quantity of adipose substance, which fills up the interstices — the eye is thus supported, and as it were cushioned in its natural position, admitting of rotation upon its axis, and of being directed to every point in the field of view which lies before it. The muscles are closely collected together at the back part of the orbit where it is very narrow; they spread apart from one another where they embrace the globe of the eye, and are inserted into its outer coat or membrane. It will be observed that there are seven in all: one however belongs to the upper eye-lid, (fig. 1, 2, No. 1,) the rest appertain solely to the globe of the eye. Four of these are called straight muscles, from their direction, (fig. 2, No. 4, 5, 6, 7,) and two are oblique, (fig. 2, No. 2, 8.) The four straight muscles are attached behind to the sphenoid bone, round the aperture which transmits the optic nerve; their opposite ends are inserted into the outer membrane of the globe of the eye, at opposite points of its circumference, as may be seen in fig. 4, one lying above it, another beneath it, and one on each side.

In fig. 1, the muscles which move the globe of the eye are seen in their natural position whilst kept enclosed within the orbit, the outer half of which is cut away. In fig. 2, the muscles and the eye are more distinctly seen, for no part of the osseous structure is retained, except a small piece of the sphenoid bone, near the entrance of the optic nerve. One of those here seen, and which is drawn separately in fig. 5, acts upon the upper eye-lid, and raises it, so as to uncover the front of the eye; it is therefore called the elevator of the lid, and is the antagonist of the orbicular muscle, which closes the eye-lids; it is marked 1, figs. 1, 2. The four straight muscles are composed of fleshy fibres in the greater part of their extent; but opposite the middle of the globe of the eye, they end in thin tendons which are fixed into the sclerotic coat, about two lines and a half behind the margin of the cornea and at opposite points, as may be seen in fig. 4. These muscles are under the control of the will—they receive their nervous influence from the third cerebral nerve. As their points of insertion are anterior to the transverse diameter of the globe of the eye, and as each, before it reaches its point of insertion, curves over the rounded surface of the eye, it requires but little consideration to perceive that, when in action, their effect must be to turn or rotate the ball of the eye, as it were upon an axis—the superior one will turn the transparent part of the eye, and with it the aperture of the pupil upwards, the inferior one downwards; that which lies to the external side, will incline it outwards as in lateral vision, and that at the opposite side will turn it inwards; the effect of this will be rendered more apparent if a needle be passed through the transparent cornea, and the upper and

Fig 4. The same parts viewed in front, the straight muscles being drawn out of their natural position, in order to show their insertion at the fore part of the globe of the eye, at opposite points. No. 1. The superior oblique muscle, its pulley and a part of the frontal bone (2) to which it is attached. 3. The superior straight muscles. 4, 5, 7. The other three straight muscles. 8. The inferior oblique muscle. 9. The part of the bone from which it arises.

Fig. 5. The elevator muscle of the upper eyelid seen by itself. It arises by a pointed process at the back part of the roof of the orbit a little above the aperture which transmits the optic nerve; it widens (4) as it passes forward over the globe of the eye, and is inserted into the cartilage (5) of the upper eyelid. 6. The eye-lashes.

Fig. 6. Exhibits the two oblique muscles of the eye-ball in their natural position when viewed from before, and also some small muscles of the face which were not shown in the previous drawings. No. 1, 2. The superior oblique muscle of the eye running through its pulley. 4. The inferior oblique muscle, its direction being backwards and outwards to the globe of the eye from near the lower margin of the orbit. 5. The elevator muscle of the upper lip. 6. Part of the orbicular muscle of the lips. 7. The depressor muscle of the wing of the nose. 8, 8. The elevator muscles of the lower lip.

lower muscle be alternately pulled, either with the fingers, or a pair of forceps. If two of the straight muscles act together, for instance, the superior and the external one, the pupil will not be turned directly upwards or outwards, but to the point intermediate between these, viz. upwards and outwards. In the same way, the combined actions of the internal and inferior straight muscles will turn it downwards and inwards. By this succession, combination, and alternation of action of the four straight muscles, we are enabled to direct the transparent part of the eye, and the pupil, with the most minute precision to every point within our field of view, so as to receive the rays of light reflected from them upon the most sentient part of the retina.

These muscles are in absolute dependence upon the will. There also subsists between them and the retina a close sympathy; for when the nerve is paralysed as in amaurosis, so that it is no longer capable of being influenced by its appropriate stimulus, those transversing motions cease by which it is directed to the different objects within its field of vision, and it loses that peculiar expression which is indicative of watchfulness and intelligence. The oblique differ from the straight muscles in several particulars. They are inserted into the ball of the eye, behind its middle part; the direction of the inferior one is backwards and outwards, its fixed point being near the anterior margin of the orbit. The superior oblique muscle commences at the back part of the orbit near the origin of the straight muscles, but it passes through a cartilaginous ring or pulley attached to the upper margin of the orbit, by which it changes its direction, and runs backwards and outwards, to reach the back part of the ball of the eye, into which it is inserted about three or four lines from the entrance of the optic nerve. Both the oblique muscles may therefore be said to act upon the eye from the fore part of the orbit, as the recti do from the back part. On this was founded the opinion once entertained, that one set were the antagonists of the other—the straight muscles when in action tending to draw the eye back into the orbit, and the oblique preventing the retraction going too far. But this opinion is no longer tenable: we know that in quadrupeds, besides the straight muscles, a retractor muscle of great power is fixed to the back of the eye, yet the oblique muscles are not more strongly developed in these creatures than those that have got no retractor; and they exist in others where retraction cannot take place; inasmuch as the eye is supported not by adipose substance, but by cartilage. From what we have above observed concerning the powers of the straight muscles, it might be thought that all the necessary movements of the eye were provided for, and effected by them alone; but merely to move and direct the organ is not sufficient,—a provision is required to secure it from the injurious influences to which it is exposed. When any irritating particles come into contact with the eye, the lids are made to close, not merely to exclude these, but as it were to brush or wash them off; but this of itself would not suffice, if the eye-ball were motionless. In order to be effectual, the latter must be made to revolve and turn upwards as the lid descends, so that they shall move one upon another in opposite directions; and this is what invariably takes place in all winking, involuntary, or spasmodic motions; in these cases the straight muscles, which are the voluntary powers, cease to exercise any control, and the oblique muscles assume the direction and turn the organ upwards. It is matter of observation, that those muscles which are strictly voluntary, and which under ordinary circumstances are most readily controlled by the will, lose their power the soonest when the cerebral influence upon them is weakened or impaired. We may perceive this, says Sir C. Bell, "in the progressive stages of debility in the drunkard, when successively the muscles of the tongue, of the eyes, the face, and the limbs, become unmanageable; and under the same circumstances, the muscles which have a double office, as those of the chest, lose their voluntary motions, and retain their involuntary motions." In the case which we are now considering, the straight muscles being voluntary, lose their power before the oblique muscles, so that the latter, assuming the sole direction of the organ, roll it upon its axis, and place the transparent part of the eye under cover of the lid; the white or opaque part alone appearing in the interval between the lids, if they are partially open. This is the state in which the organ is found in the quiescence of sleep, or in the insensibility which precedes the approach of death. By means of the great variety and freedom of motion given to the eye, to which its globular form contributes not a little, and for which there is such ample provision in the number of its muscles, it is rendered capable of being an agent in the expression of desires and wants, as well as of passions and feelings. A movement of the eye accompanies that of the hand, when raised to supplicate or denounce, and in each case it assumes an appropriate expression. In persons born dumb, the eye is so constantly made the outward index of their feelings, that they become in a manner concentrated to it, giving it a character and a brilliancy quite peculiar. Do we not see the eye at one time tremblingly agitated in violent passion, then softened into pity, or glancing with anger or disdain? As these states are capable of being controlled by an effort of the will, so they admit of being simulated—the skilful actor can put them on with the characters he assumes, and delineate their workings, as if they were prompted by real passion.

PLATE VIII.

Shows some of the muscles which move the lower jaw and the tongue.

Fig. 1. Exhibits two of the muscles of the lower jaw, as seen from the outside, with their points of attachment. No. 1. The malar or cheek-bone. 2. The root of the zygomatic process, the intervening portion of the zygoma being cut away to expose the two pterygoid muscles. 3. The superior maxillary bone. 4. The lower jaw-bone. 5. The inter-articular cartilage, which is placed between the condyle of the lower jaw, and the glenoid fossa with which it articulates. 7. The condyle. 8. The external pterygoid muscle, consisting of two portions, of which one is attached to the external pterygoid plate of the sphenoid bone, and to the tuberosity of the palate bone, and the other higher up to the lower part of the great wing of the same bone: both become narrow and unite previously to their insertion into the neck of the condyle of the lower jaw, and the inter-articular cartilage. 9. The internal pterygoid muscle, to expose which part of the branch of the lower jaw with its coronoid process has been cut away. 10. The superior portion of the external pterygoid muscle. 11. The inferior portion of the same muscle.

Fig. 2. Shows the same parts when viewed from the inside. No. 1, 2. A vertical section of the sphenoid and occipital bones. 3. The frontal bone cut through, its sinus being laid open. 4, 4, 4. The turbinate bones of the nose. 5. The hard palate cut through. 6. The lower jaw-bone sawed at its symphysis. 7. A small piece of the external pterygoid plate of the sphenoid bone. 8. The internal pterygoid plate. 9. The internal pterygoid muscle which is attached above to the groove between the pterygoid plates, and below to the branch, and the angle of the lower jaw. 10. Part of the external pterygoid muscle.

Fig. 3. The tongue-bone, (os hyoides, os linguale,) its upper surface as seen from before. No. 1. The body of the bone. 2, 2. Its great horns or processes. 3, 3. Its small horns or processes.

Fig. 4. A lateral view of the same bone. No. 1. Its body. 2. Its great processes. 3. Its small processes.

Fig. 5. A lateral view of the tongue and its principal muscles. The left side of the lower jaw-bone and the tongue-bone, being retained in their natural positions, together with part of the temporal bone of the right side. No. 1. The lower jaw-bone. 2. Part of the temporal bone. 3. The styloid process. 4. The tongue-bone. 5. The mastoid process. 6. The condyle of the lower jaw. 7. Its coronoid process. 8. The section of the lower jaw at its symphysis. 9. The great process of the tongue-bone. 10. Its small process. 11. The upper surface of the tongue. 12. The stylo-glossus muscle. 13. The stylo-hyoid muscle extending from the styloid process to the tongue-bone. 14. A slit in its fibres through which the tendon of the digastric muscle passes. 15. Part of the stylo-maxillary ligament. 16. The stylo-hyoid ligament. 17. The hyo-glossus muscle. 18. The genio-hyo-glossus muscle its name expresses its three points of attachment, viz. to the inside of the lower jaw at the chin, to the tongue-bone, and to the under surface of the tongue, along its entire length, from its root to its point; it is composed of diverging, or rather radiating fibres. 19. The genio-hyoid muscle.

Fig. 6. Another view of the same parts,—the hyo-glossus muscle being thrown down, so as to expose more fully the genio-hyo-glossus and the lingualis. No. 1. The mastoid process of the temporal bone. 2. The lower jaw-bone. 3. The lingualis muscle. 4. The tongue. 5. The stylo-glossus muscle. 6. The hyo-glossus muscle reflected downwards so as to expose (3. 7.) the lingualis and (8.) the genio-hyo-glossus. 9. Part of the stylo-hyoideus muscle.

Plate 8.

Fig. 2.

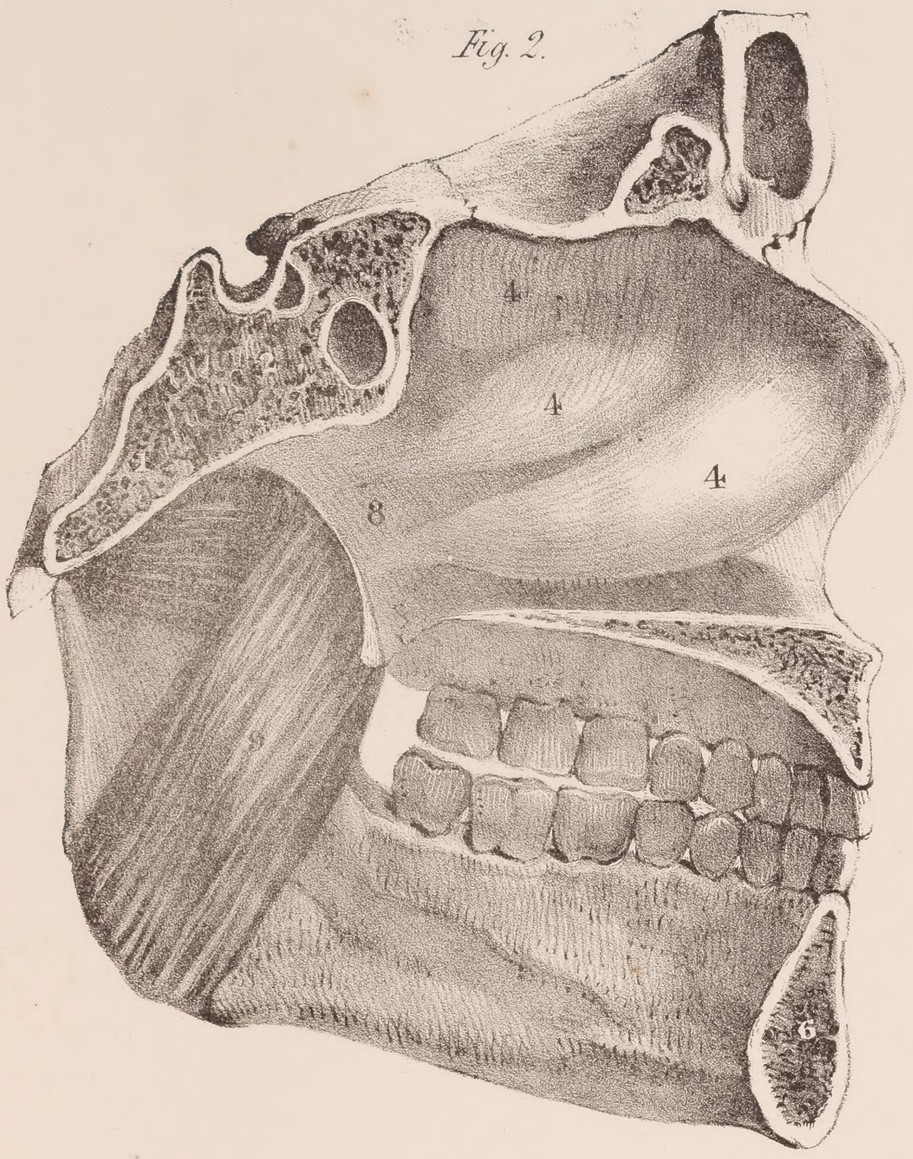
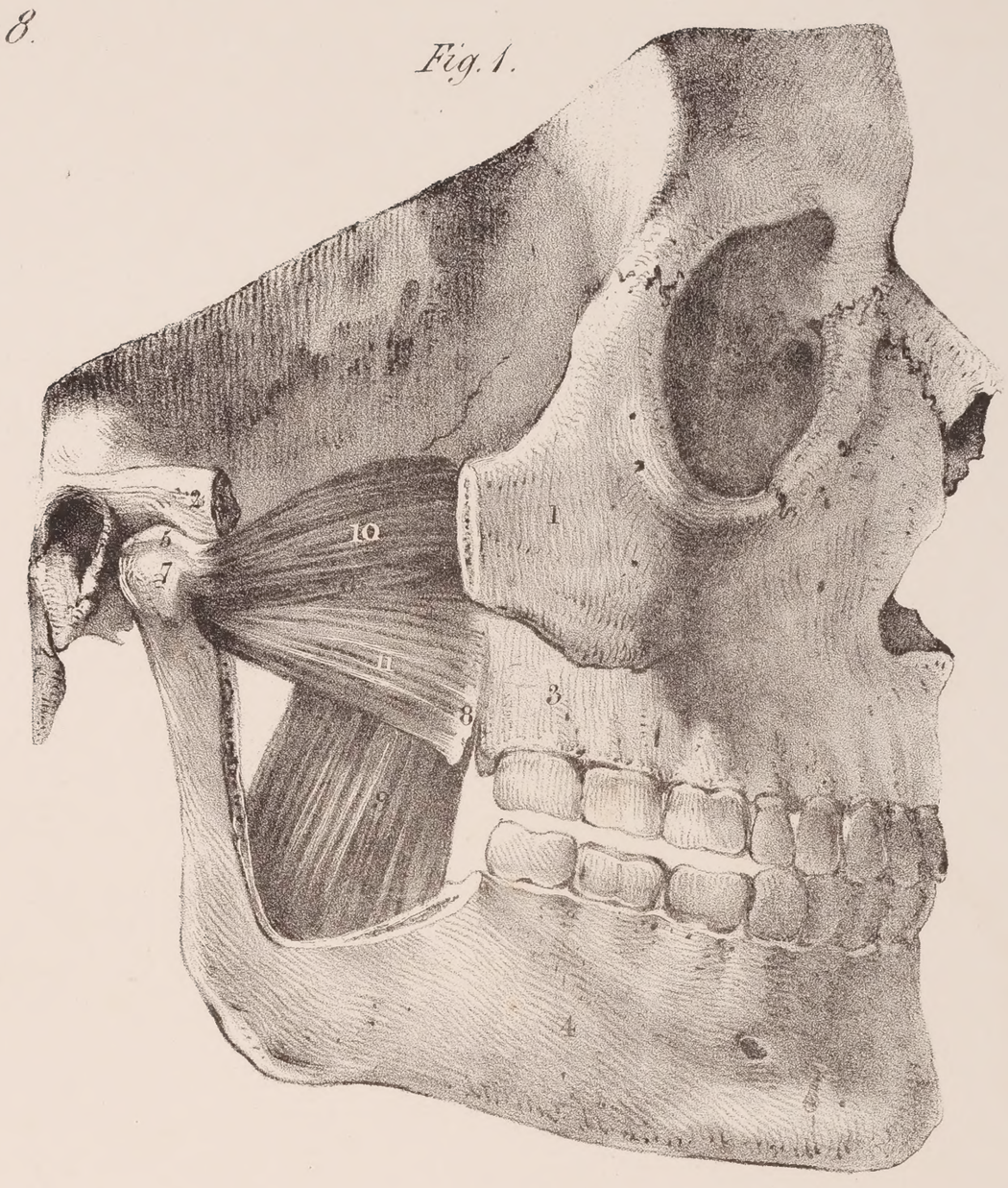


Fig. 1.



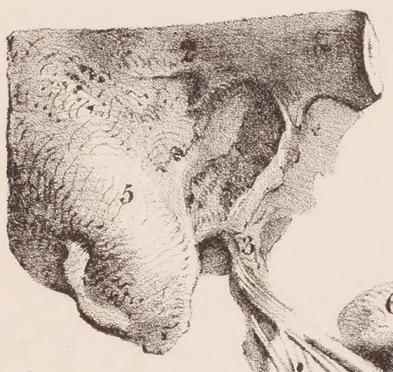


Fig. 5.

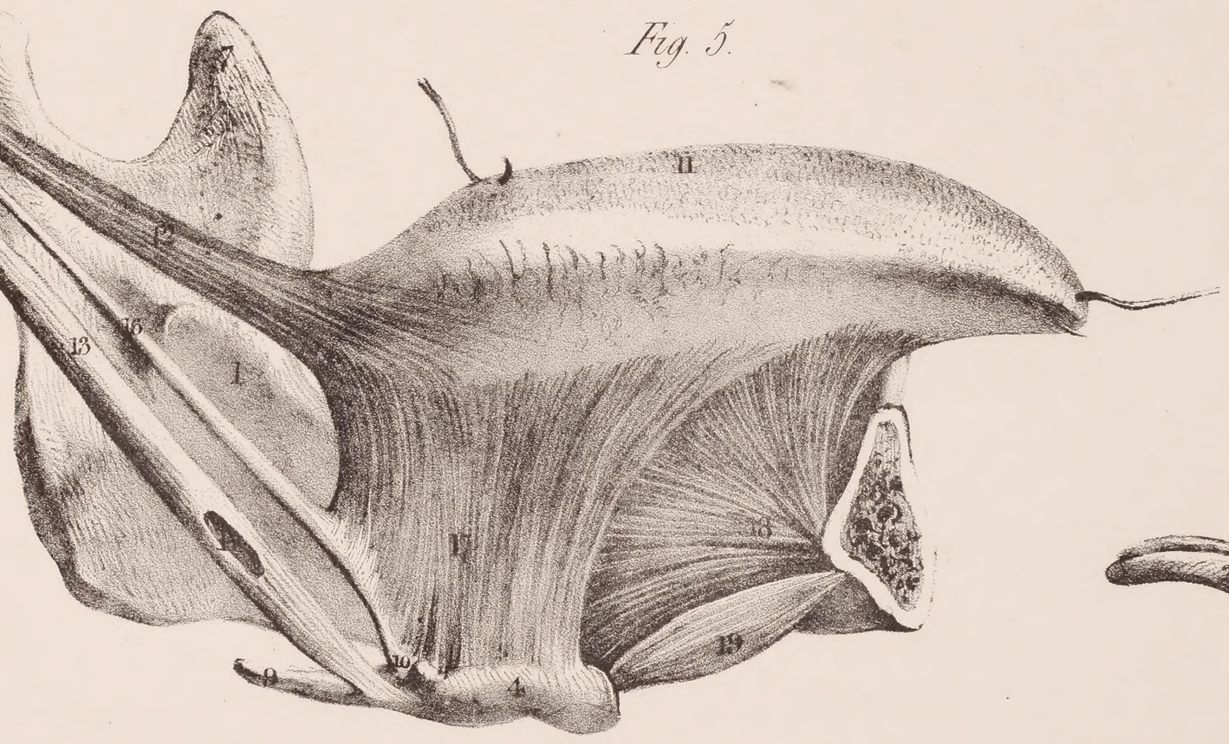


Fig. 3.

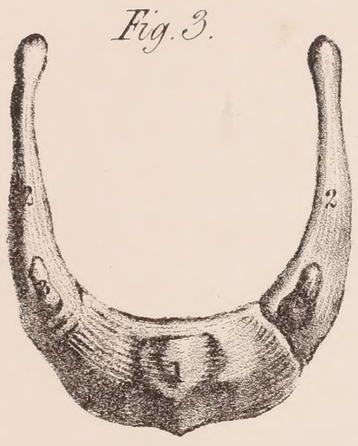


Fig. 4.

Fig. 6.

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Plate 3.

Fig. 1.

Fig. 2.

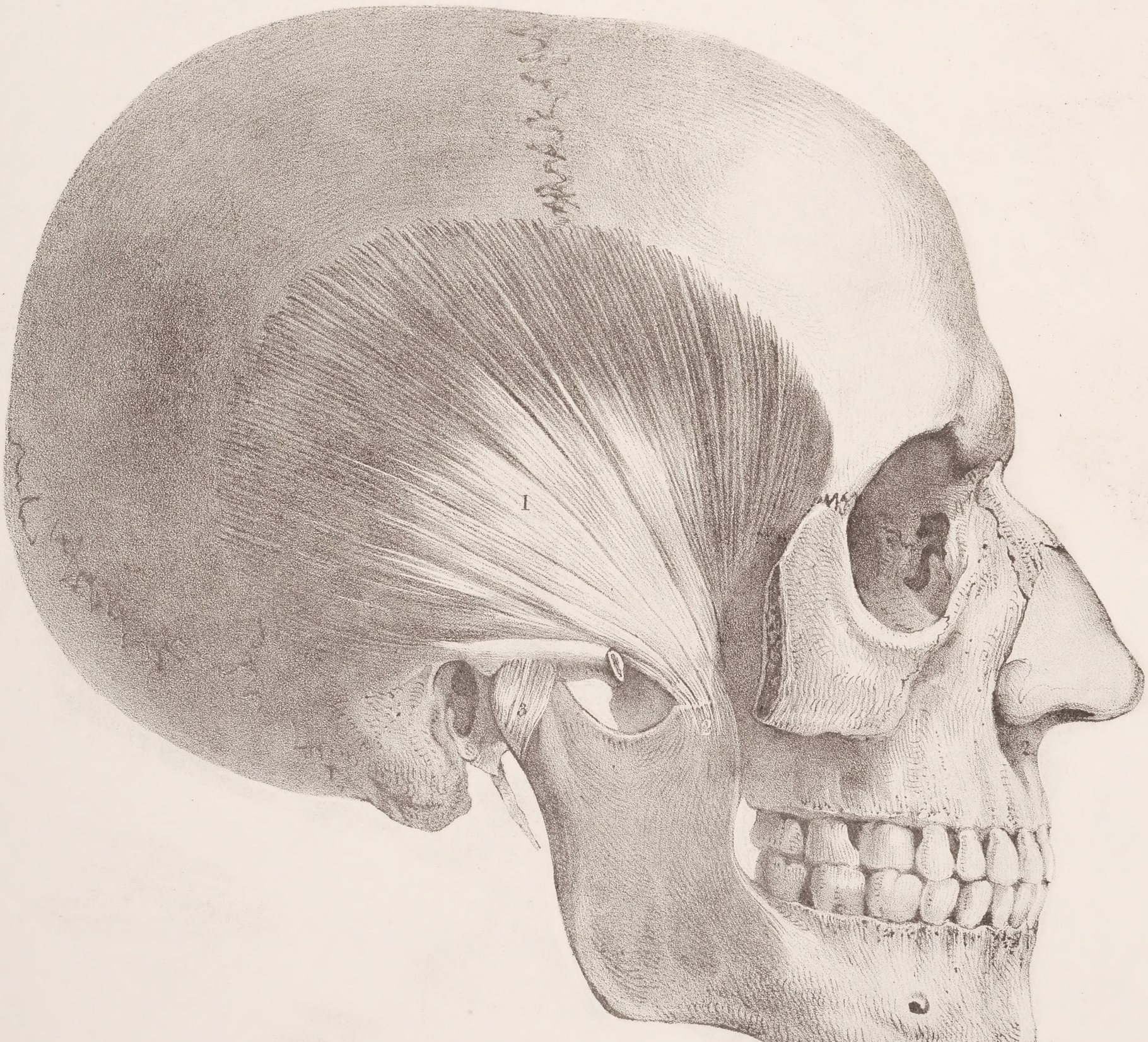

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PLATE VIII.

The first and second figures represent the pterygoid muscles which are principal agents in the movements of the lower jaw. The articulation of the lower jaw with the base of the skull is so constructed as to allow not only the hinge-like movement by which the mouth is alternately opened and shut, but also a lateral or horizontal motion, by which the lower teeth are made to rub across those of the upper jaw, in order to crush and triturate the food. The jaw may be depressed, so as to open the mouth slightly, by the relaxation of its elevator muscles, but it is drawn down so as to dilate the aperture fully by the action of those muscles which proceed upwards to it from the tongue-bone; and it is drawn up so as to close the mouth by means of the masseter and the temporal muscles which are seen in plate IX, and the internal pterygoid which is shown in plate VIII, fig. 1, 2, No. 9. In carnivorous animals these muscles exhibit their maximum of developement. In these creatures, the teeth, instead of flat crowns, present sharp cutting edges, and the movement of the lower jaw upon the upper is somewhat like that of the blades of a pair of scissors. The zygoma is strong, and inclines upwards so as to give additional power to the masseter muscle, and it moreover arches forward considerably, to accommodate itself to the great mass of the temporal muscle which lies behind it. This conformation is seen at its maximum in the head of the lion and tiger; but in the human subject the zygoma is thin, small, and very slightly arched. On referring to plate VIII, it will be seen that the lower jaw represents a lever of the third order, the fulcrum being at one end, viz. in the socket (No. 5), the resistance being at the other, and constituted by whatever is placed between the teeth to be cut or crushed, whilst the moving power, at least in the elevation of the jaw, is between these, viz. the internal pterygoid muscle No. 9, as seen in plate VIII, and the masseter as seen in plate XI, fig. 1, 19. It is not a little remarkable that this is the mechanical contrivance most commonly employed in the living fabric; it is necessarily accompanied by a loss of power, for which, however, there is ample compensation in the velocity of movement which is acquired. The direct elevation of the lower jaw is effected by the temporal muscle; the masseter and the internal pterygoid are also powerful agents in effecting this end. The obliquity of the anterior fibres of the two latter enables them also to draw the angle of the jaw somewhat forwards; and the posterior fibres of the temporal muscle run so obliquely downwards and forwards to their insertion into the coronoid process, that they seem calculated not only to elevate the jaw-bone, but also to draw it backwards; but in continued and strong efforts, for instance, when we seek to support or draw up anything by catching it between the teeth, the different lines of direction here indicated are discomposed, when the muscles all act together, and the jaw is drawn directly upwards.

We can readily push the lower jaw forwards, and make the teeth project beyond the upper dental arch by means of the external pterygoid muscle of each side, which, when they act together, will draw the condyles directly forwards. The digastric muscle draws the chin backwards, and replaces the bone acting as a retractor. In plate VIII, fig. 1, No. 8, the external pterygoid muscle of the right side is seen running backwards, and outwards, to be fixed to the neck of the lower jaw-bone and its inter-articular cartilage; it obviously can pull the condyle directly forwards towards its point of fixed

PLATE IX.

Fig. 1. Gives a side view of the muscles of the external ear, of the cranium, and of the face. 1, 1. The occipito-frontal muscle. 2. The fascia which binds down the temporal muscle, and conceals it. 3. The elevator muscle of the external ear, (m. attollens aurem; m. auriculaire supérieure.) 4. The anterior muscle of the ear, (m. attrahens aurem; m. auriculaire antérieure.) 5. The posterior muscle of the ear, (m. retrahens aurem; m. auriculaire postérieure.) 6. The orbicular muscle of the eyelids. 7. The pyramidalis nasi muscle. 8. Part of the triangular muscle of the nose, commonly called the compressor. 9. The elevator of the lip and nose. 10. The elevator of the upper lip. 11. The small zygomatic muscle. 12. The great zygomatic muscle. 13. The elevator muscle of the angle of the mouth. 14. The orbicular muscle of the lips. 15. The elevator of the lower lip. 16. The depressor of the lower lip. 17. The depressor of the angle of the lip. 18. The buccinator muscle. 19. The masseter muscle, its external or large portion. 20. The smaller or deep-seated portion of the same muscle. 21. The external lateral ligament of the lower jaw-bone.

Fig. 2. Gives a side view of the temporal muscle exposed by removing the strong membrane called the temporal fascia seen in fig. 1, No. 2, and by removing the masseter muscle, together with the zygoma. No. 1. The temporal muscle, (m. temporalis,) which is broad and radiating at its upper part, and narrowed almost to a point at its lower extremity, where it is inserted into the coronoid process (2) of the lower jaw-bone. 3. The external lateral ligament of the lower jaw-bone.

attachment; and if the muscle of the right side acts in this way, whilst the condyle at the left side remains in its socket, the chin is made to deviate to the left side, and the lower teeth are rubbed horizontally across the upper ones. If this effort be discontinued, and the muscle of the opposite side be brought into action, the movement of the jaw is reversed, and this alternation of action by the two external pterygoids will produce that triturating motion by which any substance placed between the teeth is crushed or comminuted. The most perfect provision for this movement is made in herbivorous and ruminating animals, which are furnished with broad crowned teeth adapted to crush and triturate their food.

PLATE IX.

The movements and actions of the muscles of the forehead, eyebrows, cheeks and mouth, of which a side-view is given in this plate, have been sufficiently dwelt upon in our remarks on expression, page 6; and the uses of the masseter (fig. 1, 19,) and of the temporal muscle (fig. 2, No. 1,) have been stated in the observations just made on mastication. The muscles which are attached to the external ear have seldom any power of action in the human subject; but in several of the lower animals they are highly developed and obedient to the will, which enables these creatures to turn the hollow of their ears towards that point from which sounds issue, or from which they apprehend danger or surprise.

PLATE X.

The uses of the different muscles here exhibited have been already detailed in our remarks on the movements of the jaw, the tongue, and the larynx, in deglutition and mastication.

Dislocations of the lower jaw.—The different pieces which compose the skeleton, are connected one to the other in various ways,—no motion whatever is admitted between some, a restricted movement takes place in other cases, whilst in some a free motion is provided for in various directions. It often happens that the bones which form the joints, particularly in the limbs, are thrown by various accidents into new situations, so as to lose their natural position and relation with regard to one another; in other words, they are displaced, or to use the technical phrase, dislocated. In studying the dislocations of a particular joint, it is usual to enquire in how many ways they may occur; and this includes a consideration of the form and mutual adaptation of the articulating surfaces of the bones,—of the arrangement and form of the ligaments which connect them,—the direction of the shafts of the bones themselves, and above all, the direction, power, and modes of action of the different muscles placed round the joint. Dislocation occurs much more frequently in some joints than in others, arising from the great variety and freedom of motion which they admit of; and also from the effects of pressure being more frequently transmitted to them: for instance, the shoulder-joint is so constructed, that the head of the arm-bone moves in every direction upon a small and shallow surface in the scapula or blade-bone, from off which it may pass in different directions with great freedom, so far as the form of the articulating surfaces and the structure of the ligaments are concerned; and this natural liability to displacement is encreased by the circumstance that persons instinctively throw out their hands whilst falling, in order to protect themselves, and so the pressure and the concussion become propagated by the bones to the shoulder-joint, and dislocation is produced. To this natural liability to such accidents, there is further added, in many instances, what may be termed an acquired one, owing to a laxity of the ligaments produced either by effusion into the joints, or by previous dislocations, and still more by weakness of the surrounding muscles, resulting from previous dislocations, or caused by paralysis. When such a state of muscle and ligament exists at the shoulder-joint, dislocation often occurs from slight causes; and owing to a similar state of relaxation in the articulation of the lower jaw, dislocation has occurred in some individuals whilst yawning. The lower jaw-bone admits of three displacements: first, both its articulating processes are thrown forwards under the zygomatic arch; secondly, one of them is brought forward, whilst the other remains in its natural state; lastly, it may slip before the inter-articular cartilage, owing to relaxation of the ligaments. The last is termed subluxation of the jaw; the first is the complete dislocation; the second is termed partial: all, however, take place in one direction, viz. forwards. The head of the bone cannot go backwards, for that would require that its dental arch should ascend to a level above its position when the teeth are closed, which is quite impossible: it is opposed, moreover, by the osseous plate of the auditory tube, and is not promoted by the action of any muscle; on the contrary, it is opposed by the external pterygoid muscles. Displacement directly inwards is prevented by

the structure of the articulating surface, and by the spine of the sphenoid bone; and as it could only be produced by a blow upon the cheek, a force so applied would break the bone more readily than it could displace its articulating extremity. Dislocation of the lower jaw cannot occur in infants, for in them the branch of the bone forms an obtuse angle with its body, so that the neck which supports the condyle is nearly in the same direction as the body of the bone. While such a conformation exists, the action of elevator muscles would tend to press the bone more closely to its socket rather than draw it forwards out of its place. This accident can occur only when the bone is fully formed, and when its branch, or ascending part, forms nearly a right angle with its body, as is here delineated, (plate IX, fig. 2.) When the jaw is alternately depressed and elevated, it moves as it were upon an imaginary centre, corresponding with the middle of its branch, which is the flat square part projecting upwards, nearly at a right angle with its body or horizontal part. If a pivot be driven through the bone at this point, it will at once be perceived on depressing the jaw, that its angle passes backwards and upwards, whilst its head moves downwards and forwards, describing small arcs of circles. If this motion be carried to a considerable extent, as in gaping, the direction of the masseter muscle, (plate IX, fig. 1, No. 19,) is rendered more oblique than in the natural state, so is the internal pterygoid muscle, and the masseter will be observed under such circumstances to be stretched downwards and backwards towards the angle of the jaw. Now, if in such a state of things, a slight blow be given to the jaw, the muscles may be made to contract suddenly, and concentrating their force upon the angles of the bone, they are enabled to draw them forwards, and thereby press the condyles under the arch of the zygoma. It is very likely that the depressor muscles at the same time give a certain degree of fixity to the chin; and also that the external pterygoid muscles draw the condyles forwards, thus contributing to produce the displacement. When this accident occurs, the appearance of the patient is that of forced and continued yawning; the mouth gapes, the cheeks and temples are flattened, for the masseter, the temporal, and buccal muscles are lengthened, and in a state of tension; the external pterygoid muscles are relaxed. The elevator muscles are the antagonists which oppose our efforts to replace the bone in its natural position. To overcome their resistance, the surgeon avails himself of an expedient, which enables him to act on the jaw itself, as if it were a lever of the first order; and it can be rendered such by placing a fulcrum, or prop, at each side, behind the last grinder teeth, at the angle formed by the body and the branch of the bone; and a piece of firm cork will suffice for this purpose. If the patient be placed in the horizontal position, with his head supported on a pillow, and the corks are inserted between the jaws as just stated, by placing the hand under the chin, and drawing it steadily upwards, the angles of the bone will be pressed backwards and downwards, the muscles will be kept still more on the stretch, fatigue will be induced in them, and their resistance will gradually cease, and the bone will pass backwards into its place. Some of the fibres of the opposing muscles may assist in promoting this end; for those which form the lower part of the temporal muscle, (plate IX. fig. 2, No. 1,) by reason of their direction, are enabled to draw the coronoid process of the bone backwards, and some of the deep-seated fibres of the masseter can give the branch of the bone a similar direction. When the power is applied in the way above directed, to the chin or front of the bone, the resistance is at the opposite end, and the fulcrum between both; the process of reduction becomes a mechanical contrivance by which we convert the jaw into a lever of the first order.

Partial dislocation of the jaw consists in the displacement of one of its condyles, which is drawn forwards under the zygomatic arch, whilst the other remains in its place. The chin, in such accidents, necessarily deviates to the side opposite to that in which the dislocation has occurred; so does the dental arch of the lower jaw, which also protrudes beyond that of the upper one. The mode of reduction is the same in this case as when the dislocation is complete, save only that one fulcrum placed between the jaws will suffice.

The subluxation of the jaw arises from relaxation of the ligaments, and consists of a displacement of the condyle from its inter-articular cartilage, by which the jaw becomes motionless for a time, the mouth being kept slightly opened. Surgical assistance is seldom required in such cases, as the patient's muscular efforts alone generally succeed in righting the displacement.

PLATE XI.

We have here given Cloquet's dissection of the pectoral muscles, with part of the deltoid and of the biceps. The insertion of the pectoral muscle into the humerus not being perceptible in fig. 1, it is shown in fig. 2, No. 6, where it appears in the form of a flat tendon, doubled on itself previously to its insertion into the anterior border of the groove which lodges the long tendon of the biceps muscle.

The great pectoral muscle, fig. 1, No. 8, consists of fleshy fibres in the greater part of its extent; its insertion is tendinous, its points of attachment along the sternum are aponeurotic, and along the clavicle it is slightly aponeurotic. It reaches from the last-named bone down to the cartilage of the seventh rib, along which it arises by an oblique border. The middle fibres of the muscle extend transversely outwards; those which come from the clavicle descend, whilst the inferior fibres ascend, and as they pass to their insertion they lie posterior to the others; by this arrangement they become folded along the anterior margin of the axilla. This muscle is subjacent to the skin and superficial fascia, the mamma alone interposing towards its middle, and some fibres of the platysma myoides towards its upper part. The deltoid muscle, fig. 1, No. 9, forms a fleshy cap, which covers the shoulder-joint; its fibres are arranged into thick and coarse bundles; it overlays the tendinous insertion of the pectoral muscle, and conceals those different structures which lie around the joint, and which can be exposed only by its removal, as is seen in fig. 2. When the pectoral muscle is brought into action, it draws the shaft of the humerus inwards to the side, and then forwards upon the chest if its effort be continued. If the arm be previously everted, this muscle, by its mode of insertion, is enabled to assist in rotating it inwards; and when the arm is elevated into the vertical direction, the lower or ascending fibres of the pectoral muscle will draw it downwards. If the humerus be fixed, then this muscle can be made to reverse its mode of action, so as to draw upon the chest, by taking its fixed point upon the arm. Thus when, by elevating his arms, an individual catches an object placed above him, and seeks to elevate his body as in climbing, the pectoral muscles will combine with others, to draw the body upwards. This power of acting on the chest when the arms are fixed, enables it to dilate the walls of the cavity in the efforts of forced inspiration. When the arm of a crutch is placed under the axilla, and the lower margin of the pectoral and latissimus, fig. 1. 12, are made to rest upon it, these muscles, by taking their fixed points at the humerus, which is rendered steady as soon as the hand grasps the crutch, will act upon the chest, and pull it upwards towards the fulcrum upon which they rest. In this way the body is lifted and supported, at the same time a slight effort sufficing to carry the legs onwards in progression.

PLATE X.

The second layer of muscles placed at the front of the neck is here shown in the position in which they are ordinarily seen during dissection, when the middle of the neck is supported by a block, and the head is extended backwards. The sterno-mastoid and the platysma muscles are taken away, together with the cervical fascia.

No. 1. The lower jaw-bone. 2, 2. The mastoid processes of the temporal bone at each side. 3, 3. The clavicles. 4. The under surface of the acromion process of the scapula. 5. The extremity of the coracoid process. 6. The glenoid or articulating cavity of the scapula. 7. The first bone of the sternum. 8, 9, 10. The three upper ribs. 11. The digastric muscle. 12. The stylo-hyoid muscle. 13. The mylo-hyoid muscle of the left side, which is attached to 14, The tongue-bone. 15. The oblique fibres of the muscle just named, inclining inwards to meet those of its fellow of the opposite side, which, however, is here taken away to expose the two following muscles, viz. 16, The genio-hyoideus, and 17, The hyo-glossus. 18. The sterno-hyoideus muscle. 19. The sterno-thyroideus muscle of the right side, partly covered by the preceding muscle. 20. The sterno-thyroid muscle of the left side, which is here exposed by removing the sterno-hyoideus. 21. The thyroid cartilage. 22. The thyro-hyoideus muscle, which is continued upwards from the oblique line into which the sterno-thyroid is inserted almost as if it were a prolongation of it. 23. The omo-hyoideus muscle, seen in its entire length. The upper part lies parallel, and on the same plane with the sterno-hyoideus muscle, whilst the lower part extends downwards and backwards to the upper border of the scapula, into which its fibres are fixed as well as into the ligament (24) which crosses the supra-scapula notch. 25. The anterior scalenus muscle. 26. The posterior scalenus muscle. 27. The rectus anticus major muscle. 28. Part of the levator anguli scapulæ muscle. 29. Part of the splenius muscle. 30. The membrane (thyro-hyoid) which connects the thyroid cartilage with the tongue-bone. 31. The membrane (crico-thyroid) which connects the cricoid with the thyroid cartilage. 32. The first ring of the wind-pipe. 33. The cricoid cartilage. 34. The thyroid gland. 35. The rings of the wind-pipe. 36. The upper intercostal spaces.

Fig. 2. The first bone of the sternum is here seen detached in order to show the points of origin of the sterno-hyoid and sterno-thyroid muscles, which can only be seen in part, as in fig. 1,—18, 20, so long as the sternum is in its natural position. 1. The posterior surface of the first bone of the sternum. 2, 2. Parts of the clavicles. 4, 4. The cartilage of the first rib at each side. 5. The sterno-thyroid muscle. 6. Part of the left sterno-hyoid muscle. 7. The right sterno-hyoid muscle.

Fig. 3. This gives a side view of the thyroid cartilage and the hyoid bone, together with the membrane and the muscle which connect them. 1. The hyoid, or tongue-bone. 2, 2. Its small horns or processes. 3. The large horns. 4. The thyro-hyoid membrane. 5. The thyro-hyoid ligament. 6. The thyroid cartilage. 7. Its upper cornu, or process. 8. Its lower cornu, or process. 9. The oblique ridge on the side of the thyroid cartilage, which gives insertion to, 10, The sterno-thyroid muscle, and origin to, 11, The thyro-hyoid muscle. Behind these is a part of the inferior constrictor muscle of the pharynx, spread out from its attachment to the side of the thyroid cartilage.

Plate 10.

Fig. 1

Fig. 3.

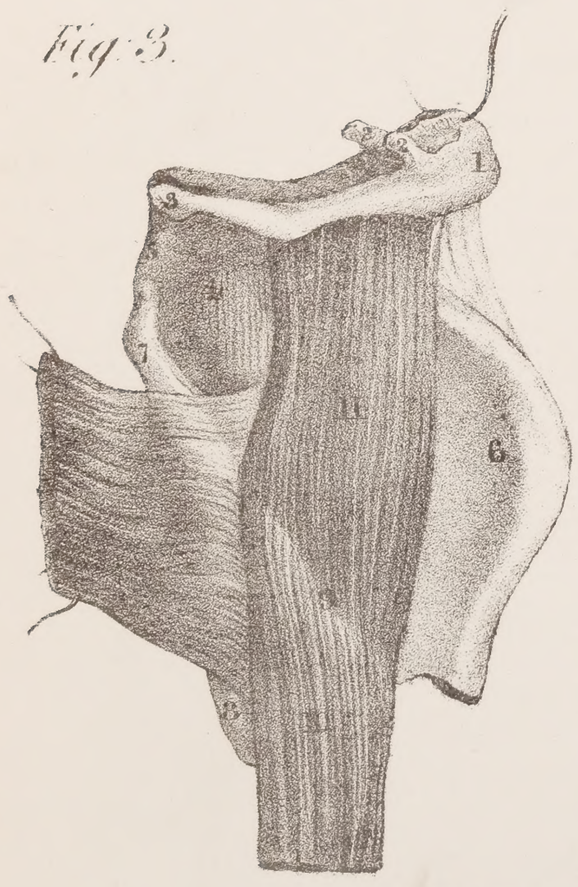

Fig. 2.

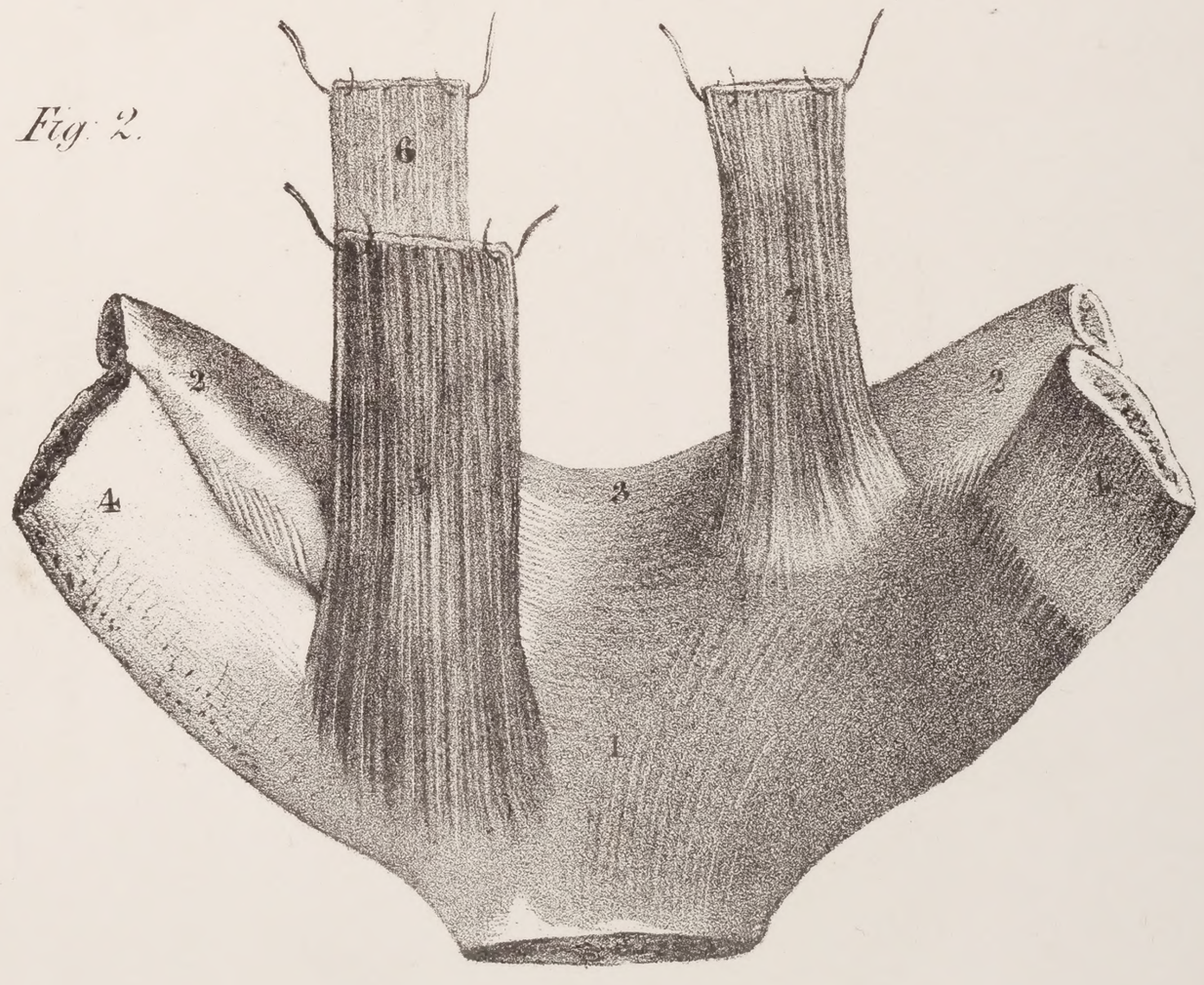

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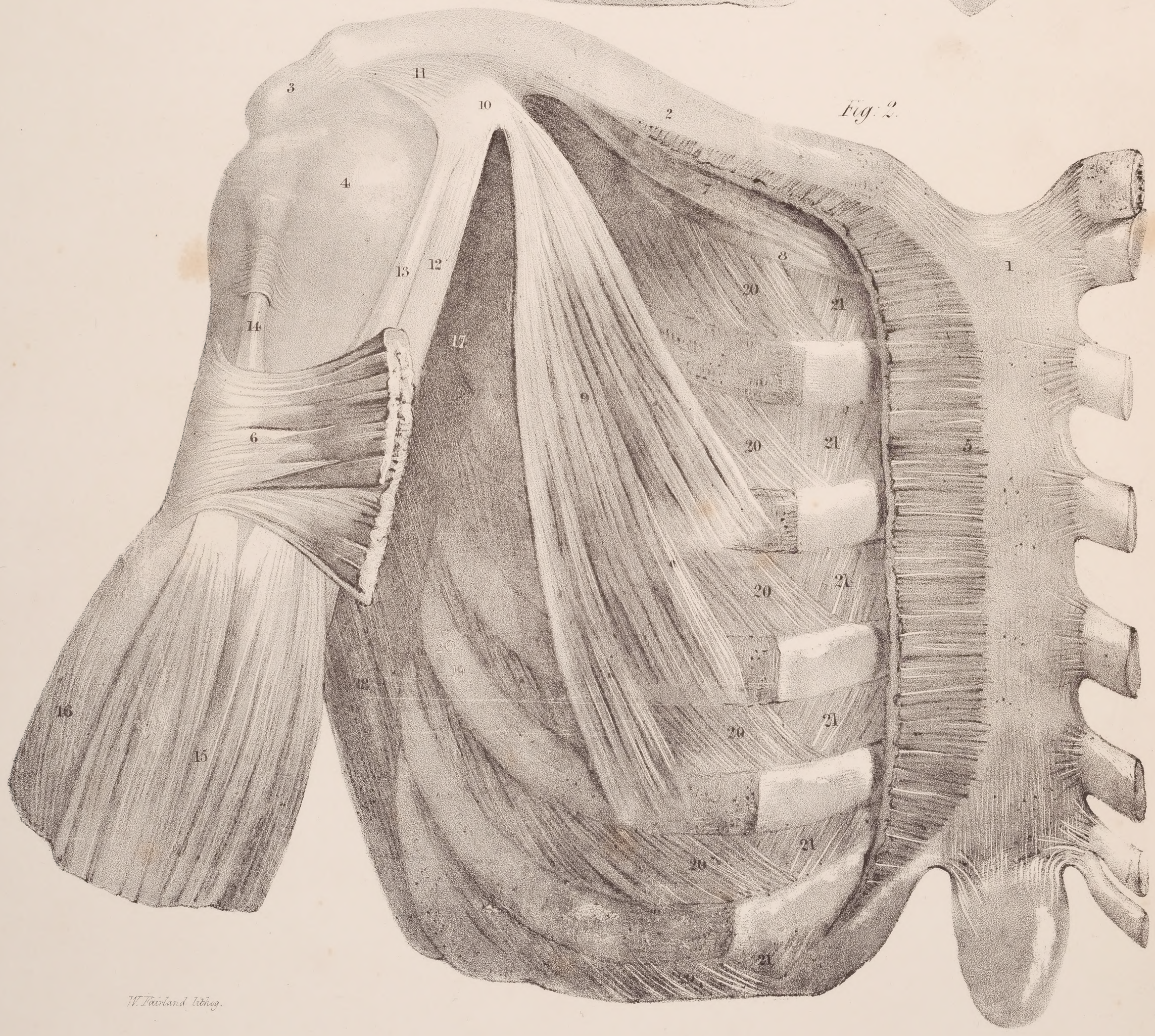
Plate 11.

Fig: 1.

Fig: 2.



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The deltoid muscle draws the arm outwards from the side, so as to bring it into the horizontal position, and by a continuance of its effort it can lift the arm upwards nearly into the vertical direction. When the arm is thrown outwards from the side, the anterior fibres of the deltoid can assist the pectoral muscle in drawing it forwards towards the chest, and the posterior fibres, (which, however, are not seen in this drawing, as they come from the spine of the scapula,) can move it backwards.

Fig. 2. exhibits the subclavius muscle, 7, and the small pectoral muscle, 9, in such a way as to render their actions readily intelligible. The subclavius is a long and narrow muscle, stretched obliquely from the cartilage of the first rib outwards, to be fixed to the under surface of the clavicle. When in action, it will depress the clavicle, and assist in drawing it forwards; but if the shoulder is fixed, then it will act on the first rib and steady it, assisting thereby to make it the point towards which the other ribs are drawn in inspiration.

The small pectoral muscle, 9, extends obliquely upwards and outwards, to be fixed to the coracoid process of the scapula. It therefore crosses the axilla and axillary vessels, and when the parts are in their natural position it is covered by the great pectoral muscle. It was sometimes called the small anterior serrate muscle, in consequence of its attachment to the ribs by angular processes. When in action, it can draw the coracoid process downwards and forwards, giving thereby a similar inclination to the shoulder-joint; in which movement the inferior angle of the scapula is made to move backwards and a little upwards. If, however, the lower part of the serratus magnus is in action at the same time, the shoulder is made to come directly forwards. This muscle can assist in dilating the chest, for if the shoulder be previously fixed, it will act from the coracoid process and draw upon the ribs to which it is attached.

PLATE XI.

This Plate commences the delineation of the muscles which move the upper extremity.

Fig. 1. Shows the great pectoral muscle, which is extended outwards to the arm from the breast-bone, and the cartilages of the ribs; also a part of the deltoid muscle, which lies over the point of the shoulder. No. 1. The right clavicle. 2. The acromion process of the scapula. 3. Part of the left clavicle. 4. The sternum or breast-bone. 5. Its cartilaginous appendage, (called, from its shape, xiphoid or ensiform). 6. The cartilages of the true-ribs. 7. The cartilage of the seventh rib of the right side. 8. The great pectoral muscle (m. pectoralis major; le grand pectoral). 9. The anterior part of the deltoid muscle, which is broad above at its attachment to the clavicle, to the acromion and the spine of the scapula, and narrow at its insertion into the humerus, giving it a triangular form, not unlike that of the Greek letter Delta, from which circumstance its name is taken. 10. Part of the subclavius muscle; placed deeply under cover of the clavicle, but perceptible in the interval between the two preceding. 11. Part of the small pectoral muscle, which is also deeply seated. 12. Part of the great muscle of the back (latissimus dorsi), which is here seen forming the posterior fold of the arm-pit; the lower margin of the great pectoral muscle forms the anterior one. 13. Some fibres of the great serratus muscle, seen in the interval between 12 and 8. 14, 15. The fleshy part of the biceps, or two-headed flexor muscle of the arm. 16. The origin of the anterior brachial muscle, just below the insertion of the deltoid.

Fig. 2. Shows the parts which are seen after the removal of the pectoral and deltoid muscles. 1. The sternum. 2. The right clavicle. 3. The acromion process. 4. The capsular ligament of the shoulder-joint, covering the head of the humerus. 5. Part of the fibres of the great pectoral muscle, left at their connexion with the sternum. 6. The external part of the same muscle, which becomes flat and tendinous at its insertion into the humerus. 7. The subclavian muscle, lying along beneath the clavicle, to the under surface of which it is attached; its inner extremity is fixed to the cartilage of the first rib, (8.) 9. The small pectoral muscle (m. pectoralis minor; petit pectoral), which is attached by separate processes to the third, fourth, and fifth ribs, from which its fibres pass upwards and outwards, to be inserted into the coracoid process of the scapula (10.) 11. The triangular ligament stretched from the coracoid to the acromion process, so as to overhang the shoulder-joint. 12. The coraco-brachial muscle (m. coraco-brachialis). Its name expresses its points of attachment to the coracoid process and the humerus. 13. The inner, or short head of the biceps muscle, which is attached above to the coracoid process conjointly with the preceding muscle, in apposition with which it descends along the fore part of the humerus. 14. The external, or long head of the biceps muscle, seen after it has emerged from under cover of the capsular ligament of the shoulder-joint; the upper part of the tendon runs over the articulating head of the humerus, and is fixed to the top of the glenoid cavity of the scapula. As it runs through the joint it is surrounded by a tubular process of its synovial or lining membrane. Some of the fibres of the capsular ligament are here shown arching across the groove in the bone which lodges the tendon, so as to allow it to pass down freely. 15. The fleshy body of the muscle placed at the fore part of the upper arm, where it makes a considerable projection. 16. Some fibres of the anterior brachial muscle. 17. Part of the subscapular muscle, lying deep in the axilla. 18. Part of the great teres muscle, lying below the preceding. 20. The external intercostal muscles, placed between the ribs. 21. Part of the internal intercostal muscles.

PLATE XII.

We have here some muscles shown in connexion with the chest and shoulder, which are still more deeply seated than those seen in the previous drawings. Along the side of the chest, and resting upon the ribs and intercostal spaces, is a muscle of considerable extent, (25,) which reaches from the first, but sometimes from the second rib, as far down as to the ninth. To expose it, the clavicle is sawed through, and the shoulder, with the scapula, drawn backwards. It is attached to the ribs by nine angular points, like the teeth of a saw, from which circumstance it has been called "serratus;" the other ends of its fibres are fixed along the posterior border of the scapula, a considerable number of them being concentrated towards its inferior angle. When in action, it draws the scapula forwards, and at the same time, by a slight effort, it can elevate the point of the shoulder, for it gives the scapula a rotatory motion, by means of which, whenever its inferior angle is drawn forwards, the glenoid cavity is necessarily turned a little upwards, and with it the shoulder-joint. It is in this way that the serratus contributes to support the shoulder when a heavy burden is placed upon it. In every effort which we make when pushing anything forwards, this muscle is necessarily in action in order to fix the scapula, and make it a steady support for the humerus. When such efforts as these are about to be made, the ribs must be rendered immoveable by a preparatory adjustment, in order that the muscle may have fixed points, from which to act along the side of the chest. This can be done by taking a full inspiration so as to distend the chest, after which the lower border of the cavity is kept fixed by the abdominal muscles and the diaphragm, and the air is prevented from escaping by the closing of the chink in the larynx. The necessity of this preparatory effort is rendered apparent in persons who have a fistulous opening in the wind-pipe, which allows the air to escape, for they cannot fix the chest so long as the aperture remains open. M. Bourdon some time since ascertained the fact to be as here stated, by direct experiment. He made an opening into the wind-pipe of a dog that was accustomed to jump and tumble about when bidden; after the operation the animal was no longer able to make any similar effort, though evidently willing to do so; but when the wound was closed the lost power was immediately restored. The serratus muscle can, like most others, reverse its line of action; instead of acting as it ordinarily does upon the scapula, it can readily be made, if this bone be fixed, to act on the ribs, and draw them upwards and outwards, by which means it becomes a powerful agent in forcible inspiration.

The subscapular muscle, (24,) acts upon the humerus, and makes it turn upon its own axis, rotating it inwards. It assists in drawing the arm towards the side if it has been previously thrown outwards, and also contributes to keep the head of the bone in close apposition with the surface of the shallow cavity with which it articulates.

The scalenus anticus, (22,) can slightly bend the vertebral column laterally, and if the two muscles of opposite sides act together, they will contribute to maintain it in the erect position. If the neck be fixed, these muscles, acting from above, will draw on the first ribs, so as to fix them, and make them the point towards which the other ribs will move in inspiration.

The posterior scalenus, (21,) exerts the same influence upon the vertebræ and ribs, which the anterior one does. The elevator of the angle of the scapula, (No. 20,) draws upwards the superior angle of the scapula, particularly if it has been previously depressed; by this movement the glenoid cavity and the shoulder are inclined downwards. When the shoulder and scapula are fixed, it can act on the cervical vertebræ, and draw the spine towards the side.

Dislocations of the Clavicle.—The clavicle is more frequently the subject of fracture than of dislocation. Boyer says these accidents occur in the proportion of six to one. Yet were we to look at the structure of the sternal or acromial articulations of the bone, we should at first be disposed to think that dislocations frequently occur in them. The inner extremity of the clavicle rests upon a shallow notch in the upper angle of the sternum, beyond which it projects considerably, and the external extremity is connected with the acromion by a narrow plane surface, both conditions being apparently favourable to dislocation. The comparative infrequency of the accident is owing not merely to the ligaments which form the joints just named, but also to the accessory ligaments which connect the clavicle with the coracoid process (coraco-clavicular) and with the first rib (costo-clavicular). Moreover, in the concussion produced by a fall either on the hands or on the shoulder, a long thin bone such as

the clavicle, will, when bent much beyond its natural curve, give way and suffer fracture towards its middle more easily than be displaced at either extremity. The inner end of the bone may, however, be thrown forwards upon the sternum. Dislocation downwards is altogether impossible, for the first rib lies beneath it; there is no case recorded of dislocation directly upwards; and though most writers admit the possibility of the displacement backwards, they do not cite any case in which it occurred as the result of violence. When the clavicle is dislocated forwards upon the sternum, the shoulder is depressed a little, and its point brought a little nearer to the central line of the body than that of the sound limb, for it is no longer borne off by the clavicle. The patient experiences difficulty in the movement of the arm, particularly in the direction upwards or forwards, his head inclines towards the affected side, and the clavicle no longer retains its natural position. It should be recollected that the line of that bone is not exactly horizontal; its outer extremity is raised a little, so that its direction is from without inwards, downwards, and a little forwards. When dislocated, the slight degree of obliquity which it naturally possesses is much increased, owing to its inner extremity being pressed downwards and forwards upon the sternum, where it forms a prominent tumour. This dislocation is more likely to happen in females and in young male subjects than in adult males. It may be produced by a forcible retraction of the shoulders or by a fall upon the point of the shoulder. Its reduction is easily effected, by placing the knee between the scapulæ, and then drawing the shoulders backwards, when the bone will drop into its natural position; but it will slip out of its place again if the arm be not supported, and the shoulder borne off from the side by the application of a pad in the axilla supported by a proper bandage, the arm being at the same time kept in a sling. Boyer expresses a decided opinion, that the sternal end of the clavicle cannot be dislocated backwards, at least by any of the ordinary causes which produce such accidents. Sir A. Cooper says he has never known this dislocation to occur from violence, and that, if ever it did happen, it could only be from a blow upon the fore part of the bone, which would rupture the sterno-clavicular and costo-clavicular ligaments, and force the bone directly backwards; but of this there is no instance on record. This displacement was, however, produced by a slow and gradual process in a person whose spine was distorted so much as to cause the scapula at one side to advance forwards and press the clavicle constantly backwards and inwards. In process of time the posterior sterno-clavicular ligament gave way, and the end of the bone slipped back behind the sternum, so as to produce considerable distress by its pressure on the œsophagus,—so much so that nothing but its removal could have saved the life of the individual.

The external or scapular end of the clavicle may be displaced from its connexion with the acromion process by a fall on the point of the shoulder, which will press the scapula downwards and inwards so as to separate it from its connexion with the clavicle. The shoulder of the affected side is necessarily depressed and inclined a little inwards. By making pressure along the spine of the scapula with the fingers, it is readily ascertained that the acromion process is no longer on the same plane with the end of the clavicle, but is sunk somewhat beneath it. The depression of the shoulder causes the skin to be drawn tightly over the projecting end of the clavicle, which renders every movement of the part painful. Finally, if the shoulders be drawn steadily back, so that the acromion may be carried outwards and upwards to its proper level, the displacement is at once reduced, but it will speedily recur if the shoulders be left without support. From this it follows, that in the management of such an accident, adequate means should be devised to raise the scapula and bear it off from the side, the arm being at the same time supported so as to prevent its weight from depressing the scapula.

Dislocations of the Shoulder.—The head of the humerus may be displaced from the glenoid cavity of the scapula, in either of three directions; it may be forced downwards into the axilla, or forwards and upwards, so as to be placed on the sternal side of the coracoid process; or backwards, so as to rest upon the posterior surface of the scapula:—finally, a partial displacement may occur, in which the head of the bone does not entirely leave the glenoid cavity, but rests partly on its inner border, and partly on the outer side of the coracoid process. The displacement backwards is a rare occurrence; it often occurs in the direction forwards; but by far the most frequent form of the accident is that in which the bone is pressed downwards.

When dislocation into the axilla has occurred, the limb is necessarily lengthened, which is rendered obvious if the patient is viewed from behind, and the position of the elbows be compared one with the other. The arm is thrown somewhat outwards, so that the elbow is removed from the side, and on examining attentively the direction of the axis of the arm, it will be found that, instead of passing upwards from the elbow to the point of the shoulder, it inclines inwards, so as to terminate about two inches below that point that is a little beneath the border of the glenoid cavity. The shoulder no longer presents that rounded form which naturally marks it, and which depends on the

support which the deltoid muscle receives from the head of the humerus. In the new state of parts consequent on the displacement of the bone, a depression exists instead of a fulness, and the want of support is readily perceived, if the fingers are pressed from point to point along the shaft of the humerus upwards, to where the deltoid appears sunk in. As the muscle last named is stretched, owing to its points of attachment being farther apart than in their natural condition, the border of the acromion process is rendered prominent, giving an appearance of sharpness to the shoulder. On searching for the head of the bone, it will very readily be found in the axilla, and can be distinctly felt, if the arm is drawn outwards a little. The power of voluntary motion is in a great degree lost; the patient can no longer move his arm upwards, or raise it towards his head; he can, however, move the limb a little forwards and backwards as it hangs by his side. The limb may be drawn outwards, and elevated a little, without causing much pain; but any effort to depress it, so as to bring it nearer to the side, is strongly opposed by the action of the deltoid, and productive of much pain, owing to the pressure of the head of the bone upon the nerves; hence it is that to relieve the pain and lessen the tension of the muscles, the patient instinctively inclines his head, and even his body, to the affected side, and supports and steadies the limb, by holding the fore arm or elbow with the other hand.

This displacement may be produced by a fall on the point of the shoulder, or by falling on the side with the elbow thrown outwards, or by falling forwards with the hands outstretched. In the two latter cases, it results partly from external violence, but still more from muscular action. For when the body comes to the ground with the elbow thrown out from the side, the line of the arm is inclined to that of the body at a considerable angle; the lower end of the arm becomes fixed by its pressure against the ground, the upper end rests obliquely against the glenoid cavity of the scapula, and the muscles which form the folds of the arm-pit, are stretched across from the body to the humerus into which they are inserted. Under such circumstances, it represents a lever of the third order, the fulcrum being at the lower end, the resistance being at the upper, and the power, viz. the muscles, being between both; from which it follows, that if the muscles are thrown into action, they will instantly overcome the slight resistance given to them at the shoulder joint, and draw the bone downwards into the axilla.

The capsular ligament is torn not only at the lower part of the glenoid cavity, but also along the whole length of its inner margin. The head of the bone rests on the lower border of the scapula to the inner side of the long head of the triceps muscle. The tendon of the subscapular muscle is also torn, the deltoid is stretched, and its fibres elongated, the supra and infra spinatus muscles are necessarily stretched too; the teres major and minor muscles suffer little change; but the coracobrachialis, the biceps, and the long head of the triceps muscles are all stretched.

PLATE XII.

Shows the deep-seated muscles at the side of the neck and the chest; also the subscapular muscle, to expose which all the parts in the axilla must be removed, and the scapula drawn backwards out of its place.

No. 1. Part of the occipital bone. 2. The mastoid process of the temporal bone. 3. The styloid process. 4. The bodies of the cervical vertebræ. 5, 5. The inner and outer ends of the clavicle, the intermediate part being cut away. 6. The acromion process of the scapula. 7. The coracoid process. 8. The ligaments which connect it with the under surface of the clavicle. 9. The upper angle of the scapula. 10. The upper part of the humerus. 11. The lower border of the scapula. 12. The ligament connecting the first rib with the clavicle. 13. The sternum. 14. Its cartilaginous appendage. 15. The sternal or true ribs. 16. Three of the asternal or false ribs. 17. The line of the base of the scapula. 18. Part of the complexus muscle. 19. Part of the splenius. 20. The elevator muscle of the angle of the scapula (m. levator anguli scapulæ; l'angulaire), which is attached at one end by three or four tendinous points to the transverse processes of the upper cervical vertebræ, and by the lower to that part of the base of the scapula which lies above its spine. 21. The posterior scalenus muscle, which is extended from the first and second ribs at their back part to the transverse processes of the six lower cervical vertebræ. 22. The anterior scalenus muscle, extending from the inner border and upper surface of the first rib upwards, to the transverse processes of the cervical vertebræ, from the third to the sixth. 23. The part of the first rib which is included between the scaleni muscles, and over which slides the subclavian artery as it passes from the neck into the axilla. 24. The subscapular muscle (m. subscapularis), which in the natural position of the parts lies deeply in the axilla under cover of the scapula.—(Plate XI, fig. 2, No. 17.)—It is here thrown forwards by the eversion of the shoulder, which shows its points of origin from the concave surface and the base of the scapula 17, and its insertion into the small tubercle of the humerus. 25. The great serratus muscle, so called from its mode of attachment to the ribs by a series of angular processes resembling the teeth of a saw. The muscle is of considerable extent; it rests upon the external surface of the nine upper ribs and the intercostal spaces, and is inserted into the whole length of the base of the scapula, the greater number of its fibres being concentrated at the lower and upper angles of the bone. 26. The intercostal muscles.

Plate 12.

W. Fairland lithog.

London: John Taylor, Upper Gower Street.

Plate 13.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

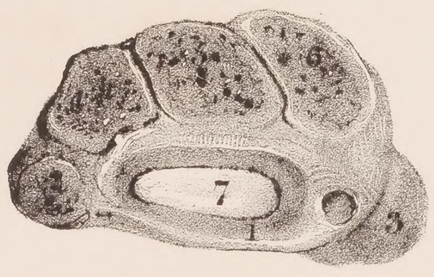

Fig. 5

Fig. 6.

W. Fairland lithog.

London, John Taylor Upper Gower.

If it is admitted as a general principle, that in the management of dislocations the muscles should be relaxed as much as possible, more particularly those which are in any way put on a stretch by the new condition into which the bones are placed, there can be little doubt as to the position into which the arm and fore-arm should be put in order to reduce with most ease the form of dislocation we are now considering. The deltoid and supra-spinatus muscles are most effectually relaxed by drawing the arm outwards and upwards from the side until it is brought into the horizontal position, so as to form a right angle with the body. Again, the biceps muscle is relaxed by bending the fore-arm upon the arm so as to form an acute angle with it. Yet this is not the position most commonly adopted; the dislocation is often reduced by placing the arm at full length parallel with the body, fixing the heel in the axilla, and pulling at the wrist, in which position every muscle which is placed in an unnatural degree of tension by the dislocation of the bone is rendered still more tense, and necessarily gives much more resistance than it would do if the limb were placed in the position above indicated. The same remark applies to the practice of reducing the dislocation by placing the knee in the axilla. The objection is lessened in some degree, when extension is made from the arm above the elbow, the fore-arm being flexed. Both modes of practice, however, succeed in recent dislocations with sufficient

PLATE XIII.

Fig. 1. Shows the fascia of the arm, and of the palm of the hand. No. 1. The inner end of the clavicle, the bone being fore-shortened in an extreme degree. 2. The coracoid process. 3. The subscapular muscle, its fibres being partly concealed by a thin membrane or fascia. 4. The anterior part of the deltoid muscle. 5. The tendon of the latissimus dorsi. 6. Part of the pectoralis major muscle: between the two last are seen, 7. The coraco-brachialis, and 8. The short head of the biceps muscle, passing down from their attachment to the coracoid process. 9. The fascia rendered prominent by the projection of the belly of the biceps muscle. 10. Indicates the place of the triceps. 11. Lies over the point into which the coraco-brachialis is inserted. 12. The position of the inner condyle. 13. Fibres given off from the tendon of the biceps muscle, which strengthen the fascia. 14, 15, 16, 17. Indicate the points at which the fascia is stretched over the supinator longus, flexor carpi ulnaris, palmaris longus, and flexor carpi radialis. 18. The palmar fascia: farther on it widens and presents distinct points of attachment to the extremities of the metacarpal bones. External to it are seen the muscles of the thumb. Those of the little finger lie to its inner border.

Fig. 2. Shows the fascia on the posterior and external part of the arm and fore-arm.

No. 1. The acromion process. 2. The spine of the scapula. 3. The thin part of the fascia covering the deltoid muscle. 3. bis. The dense fascia covering the infra-spinatus muscle. 4. The fascia, where it covers the biceps muscle. 5. The place of the triceps. 6. The place of attachment of the fascia to the external condyle :—7. To the external ridge of the humerus. 8, 9, 10. The fascia strained over the supinator, the common extensor, and the ulnar extensor. 11. The posterior annular ligament of the wrist. 12. The fascia covering the back of the hand, which is so thin as to allow the tendons of the extensor muscles to be seen through it.

Fig. 3. Shows the posterior annular ligament of the wrist, and the sheaths which it forms for the transmission of the tendons of the extensor muscles. The wrist joint has been cut across, and the radius and ulna sawed through immediately above it.

No. 1. The articulating surface of the radius. 2. The triangular ligament, which connects its inner border with the styloid process of the ulna. 3. The posterior annular ligament of the carpus. 4. The canal for the extensors of the metacarpal bone and first phalanx of the thumb. 5. One which is common to the tendons of the extensor carpi radialis, longior and brevior. 6. The canal for the transmission of the extensor of the second phalanx of the thumb. 7. One for the common extensor, and the indicator muscle. 8. That for the extensor of the little finger. 9. The sheath, or rather canal, which transmits the tendon of the flexor carpi ulnaris muscle.

Fig. 4. Shows the anterior annular ligament of the wrist, as it is stretched across from its inner to its outer border, forming with the carpal bones a ring or canal, for the transmission of the flexor tendons.

No. 1. The anterior annular ligament of the wrist. 2. The pisiform bone. 3. The trapezium. 4. The cuneiform bone. 5. The semilunar. 6. The scaphoid bone. 7. The ring which transmits the flexor tendons, near which is the small ring for the tendon of the flexor carpi radialis.

Fig. 5. Gives a side view of one of the fingers, in order to show the fibrous band or sheath which binds down the tendons of the flexor muscles; and the manner in which the interosseous and lumbricales muscles become fixed into the expanded tendon of the extensor muscle.

No. 1. A metacarpal bone. 2. The fleshy fibres of an interosseous muscle. 3. A lumbricalis muscle arising from 4, one of the tendons of the deep flexor muscle. 5. The extensor tendon running along the dorsal surface of the bone, and prolonged upon the phalanges of the finger. 6, 7. The insertion of the interosseous and lumbricalis into the border of the extensor tendon. 8. The tendon of the superficial flexor entering the sheath. 9. The fibrous sheath, which binds down the flexor tendons as they run along the palmar aspect of the finger.

Fig. 6. The same finger placed in the bent position, in order to show how the sheath binds down the flexor tendons, and increases their power; also how the lumbricales and interossei may become flexors of the first joints of the fingers.

facility, but if they produce much more pain than accompanies the reduction, when care is taken to relax the muscles, then the motive for their continuance must be that they require little apparatus, and that success justifies their continuance.

The humerus may be thrown forwards and inwards off the glenoid cavity; in which case its head will be lodged at the inner side of the neck of the scapula; it is also drawn upwards so as to be placed upon a level with the second rib at the inner side of the coracoid process, and beneath the clavicle. In this dislocation, the arm is necessarily shortened; the elbow is thrown outwards from the side and also backwards. The margin of the acromion process is prominent, and the depression beneath it is more perceptible than in the dislocation downwards. On tracing the direction of the axis of the arm, it will be seen to drop to the inner side, and above the glenoid cavity; and if the hand be placed beneath the clavicle, a tumour can be felt under the pectoral muscle, which will be found to move or roll if the elbow be rotated. The movements of the limb are very much restricted; the arm is with difficulty drawn outwards from the side, for it is checked by the coracoid process: if it be drawn forwards, its head is pressed against the venter of the scapula, and the rotator muscles restrict its motion backwards. The diagnostic marks of this dislocation are thus briefly summed up by Sir A. Cooper: "The head of the bone is below the clavicle, the elbow is separated from the side, and thrown backwards; and rotation of the arm gives motion to the head of the bone in its new position."

Though the movements of the limb are thus restricted, the pain which is felt is not so great as in the other dislocation, for the nerves are not so much compressed. This accident commonly results from a fall when the arm is thrown out from the side, and a little backwards, by which means the head of the bone is forced forwards and upwards, tearing through the inner side of the capsular ligament. The bone in its new situation has in front of it the pectoralis minor as well as major; its outer side is in immediate contact with the venter of the scapula—the subscapular muscle is partly detached from the latter surface—its inner surface is separated from the ribs by the fibres of the subscapular muscle, and the serratus magnus. The rotator muscles are stretched, as well as the posterior fibres of the deltoid muscle; the part of the latter which arises from the clavicle is relaxed, so is the pectoralis major. This dislocation may be reduced by placing the heel in the axilla, and making extension from the arm immediately above the elbow, having previously placed the limb in a state of flexion, in order to relax the biceps muscle; but this method is not so often resorted to in the present case, as in the dislocation downwards. Counter-extension is effected by means of a bandage or girth, so applied as to fix the scapula; and extension is made from the arm above the elbow, the fore-arm being bent, so as to relax the biceps; the limb should be drawn downwards and a little backwards, corresponding with the line which its axis represents in the new position in which it is placed by the dislocation. By observing this precaution, the head of the bone is drawn clear of the coracoid process of the scapula, but when it is moved downwards a little, so as to approach the glenoid cavity, the arm should be drawn forwards at the elbow, so as to facilitate the passage of the head of the bone backwards into the glenoid cavity.

The head of the humerus may be thrown backwards upon the dorsum of the scapula, where it will necessarily form a considerable tumour beneath the spine of that bone, and behind the glenoid cavity. The depression beneath the acromion in this case is not so great as in the dislocation downwards: the direction of the axis of the limb is forwards and inwards, the arm being closely applied to the side, and, as it were, inverted. When the elbow is rotated, the protuberance formed by the head of the bone in its new situation can be readily felt beneath the spine, and farther back than the point of the acromion process. In one case cited by Sir A. Cooper, free motion was practicable backward and forward, but the limb could not be raised, or carried from the side without great difficulty, (on Dislocations, p. 416):—whilst in another, p. 404, the arm could be moved considerably either upwards or downwards, but the motion in the anterior, or posterior direction, was very limited. In the few cases of this accident which we find reported, the reduction was easily effected. The counter-extension is made in the same way as in the other dislocations: by a gradual extension the limb is drawn directly outwards, so as to dislodge the bone from the dorsum of the scapula; if the elbow be then inclined a little backwards, the head of the bone will readily slip into its place.

A partial dislocation of the humerus has been known to occur in a few instances. In these, the head of the bone was not thrown altogether off the glenoid cavity; it rested partly upon its inner margin, and partly upon the contiguous portion of the coracoid process. The position of the bone thus placed, distinguishes the accident from the complete dislocation; for in the latter it lies at the sternal side of the coracoid process, and in the former at the scapular side. It may be produced by a

fall on the shoulder; after which, the shoulder no longer retains its usual roundness: a depression exists over the back part of the shoulder joint, so that the posterior half of the glenoid cavity can be perceived to be unoccupied by the head of the bone. When the upper extremity of the bone is thus thrown forwards and inwards, its axis will necessarily incline from above downwards, and a little backwards and outwards: the limb cannot be raised directly from the side, for by that movement the head of the bone is made to strike against the coracoid process, but if the elbow be drawn a little forwards, it may then be carried upwards. This form of dislocation is easily reduced; but it has a tendency to slip forwards again. The extension and counter-extension are made in this case in the same manner as in the dislocation forwards; but it is "necessary to draw the shoulders backwards, in order to bring the head of the bone to the glenoid cavity: immediately when the reduction is completed, the shoulders should be bound back by a clavicle bandage, else the bone will immediately slip forwards against the coracoid process." (Sir A. Cooper on Dislocations, p. 410.) If the clavicle bandage cannot conveniently be procured, a moderately sized pad may be placed in the axilla, and the elbow drawn forwards and inwards to the side of the chest, and retained in that position by a circular bandage, carried round the body. When the arm is thus placed, it must be obvious that the head of the bone is directed backwards and outwards, and thereby kept in apposition with the glenoid cavity of the scapula.

PLATE XIII.

This plate gives back and front views of the thin firm membrane which invests the muscles of the arm and fore-arm; it binds down the muscles like a band or sheath, from which circumstance it is called fascia; it is placed immediately beneath the skin, with which it is connected by cellular tissue, by small blood-vessels and filaments of nerves, which must pierce this membrane before they can reach the tegument. The fascia resembles a web composed of white shining fibres, which run in various directions, some transversely, and others longitudinally, so as to form a layer of membrane; the outline of the muscles can be distinctly traced, even while they are covered by the fascia, for the membrane is closely adherent to them, and also gives off from its inner surface thin plates, which project into the interstices between several of the muscles, like so many partitions. The membrane is not of uniform thickness throughout its entire extent; it is thicker and firmer on the back part and outer side of the limb, than on the inner and fore part. At the bend of the elbow, the fascia is intimately connected with the condyles of the humerus, and also with the two ridges which extend upwards along the bone from these prominent processes; the latter connexion is effected by means of two firm plates of membrane, similar in structure to the fascia, which pass from its inner surface to the bone, so as to form partitions between the extensor and flexor muscles; from which circumstance they are termed inter-muscular ligaments. They serve, however, another purpose; they give an increased surface of attachment to the muscles, for several of the fibres of these arise from them. The inter-muscular septum at the outside of the arm, reaches from the external condyle to the insertion of the deltoid; that at the inner side, from the corresponding condyle upwards to where the coraco-brachialis muscle is inserted.

At the outer side of the arm, the fascia is intimately connected with the insertion of the deltoid muscle, at which point it is strong and firm; but when traced upwards over the muscle, it becomes thin, so as to resemble a slight layer of condensed cellular tissue, rather than an investing membrane. In this altered form, it reaches as far as the spine of the scapula, and the outer part of the clavicle; behind the border of the deltoid it becomes blended with a very dense and firm membrane, which covers the infra-spinatus muscle. At the inner side of the limb it gradually becomes weak as it approaches the axilla; but it can be traced upon the pectoral muscle, and the latissimus dorsi, where they form the folds of the axillary space, for it is stretched across from the one to the other: from this point it gradually degenerates into mere cellular tissue, as it reaches the side and fore part of the thorax.

The fascia of the fore-arm is very dense and firm, particularly at the back part, and along the ulnar border; at the wrist, it is inserted into the annular ligaments. Its outer surface is separated from the tegument by the superficial veins, nerves, and lymphatics; its inner surface is intimately connected with the fibres of the muscles which arise from the condyles, and moreover gives off thin layers, which lie between them like so many septa, at the same time that they increase their points of attachment, for several of the muscular fibres arise from them.

The *anterior annular ligament* of the wrist is a strong firm band of white shining fibres, stretched across from one border of the carpal bones to the other, so as to convert the groove which these bones form into a canal. (Plate XIII. fig. 4.) Its outer end is attached to the fore part of the trapezium and scaphoid bones, the inner to the pisiform bone, and the unciform. The fascia of the arm is attached to its upper edge, and to the lower is fixed the palmar fascia: its anterior or superficial surface gives attachment to some of the muscles of the thumb, and of the little finger; the posterior is in apposition with the tendons of the flexor muscles which slide beneath it. This surface is lined by a synovial membrane, which is prolonged upwards and downwards upon the flexor tendons, and dips in between them so as to facilitate their various movements; the tendon of the long flexor of the thumb has a distinct synovial sheath.

The *posterior annular ligament* of the wrist is stretched obliquely across the extensor tendons, and retains them in their situation. It is not by any means as strong or firm as the anterior ligament; its external extremity is attached to the outer part of the radius, from whence it is stretched inwards, and turning round the inner border of the wrist becomes attached to the pisiform bone, and the anterior annular ligament. Its upper border gives attachment to the fascia of the arm, (Plate XIII. fig. 2, No. 11); from the lower extends a thin fascia which covers the back of the hand, No. 12. Its posterior surface is subjacent to the skin; and from the anterior, bands are given off which are interposed between the tendons of the muscles, and by becoming fixed to the different prominent points upon the surface of the bones, convert into canals the shallow grooves which are marked upon the lower ends of the radius and ulna. (Plate XIII. fig. 3.) These canals are lined by synovial membranes, which are reflected upon the tendons for some way both upwards and downwards.

The *palmar fascia* (Plate XIII. fig. 1, No. 18,) is a dense firm layer of fibrous structure, and of a triangular form, which extends from the anterior annular ligament of the wrist to the extremities of the four metacarpal bones, which support the fingers. Its narrow part or commencement is attached to the anterior annular ligament of the wrist, and to the tendon of the palmaris longus muscle. When traced forwards over the metacarpal bones, its fibres divide into four separate bundles, which are directed towards the extremities of the metacarpal bones: there each divides into two slips which diverge so as to leave a free passage for the transmission of the flexor tendons, and of the nerves and vessels. The slips or processes here alluded to, as they turn backwards, become fixed to the transverse and anterior metacarpal ligaments. The fibres, which in this arrangement run forward from the anterior ligament to the metacarpal bones, are interwoven with others which run in a transverse direction, so as to prevent their being separated or torn. From the edges of the palmar fascia thus disposed, a thin lamella projects inwards over the muscles of the little finger, and outwards over those of the thumb. The superficial surface of the fascia is subjacent to the skin; the deep one rests upon the flexor tendons and the palmar nerves and vessels, which it binds down and conceals.

PLATE XIV.

These two drawings show the muscles which are in intimate relation with the shoulder joint.

Fig. 1. No. 1. The clavicle. 2. Its outer end. 3. The acromion process of the scapula. 4. The ligament which connects these two bones. 5. The spine of the scapula, which is here greatly fore-shortened as the parts are viewed laterally: part of the supra-spinatus muscle is seen above it. 6. The deltoid muscle. 7. Its insertion into the humerus. 8. Part of the infra-spinatus muscle. 9. Part of the teres minor muscle. 10. The origin of the teres major muscle. 11. Part of the biceps muscle. 12. The origin of the brachialis anticus muscle, immediately below the insertion of the deltoid. 13. The long head of the triceps muscle. 14. The second or external head of the same muscle.

Fig. 2. Shows the external rotator muscles as they are seen from behind; the deltoid is removed in order to expose their insertions, as well as the points of attachment of the teres major muscle, and the origin of the two heads of the triceps.

No. 1. The acromion process. 2. The spine of the scapula. 3. The base of the scapula. 4. Its inferior angle. 5. The great tuberosity of the humerus. 6. The shaft of the bone drawn obliquely outwards and forwards. 7. The supra-spinatus muscle. 8. Its tendinous insertion into the upper part of the great tuberosity of the humerus. 9. The infra-spinatus muscle. 10. The teres minor muscle. 11. Its insertion into the lower part of the great tuberosity of the humerus. 12. The teres major muscle. 13. Its insertion into the posterior border of the bicipital groove of the humerus. 14. The long head of the triceps muscle; its fibres coming downwards from the lower border of the scapula; its origin however is here concealed by the teres minor. 15. The second or middle head of the triceps muscle, arising from the shaft of the os humeri; its upper fibres form a pointed process, which reaches nearly as far as the insertion of the teres minor into the great tuberosity of the humerus. 16. Part of the deltoid remaining at its insertion, the rest being cut away.

Plate 14.

Fig 1.

Fig 2

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Plate 15.

Fig: 1.

Fig: 2.

Fig: 3.

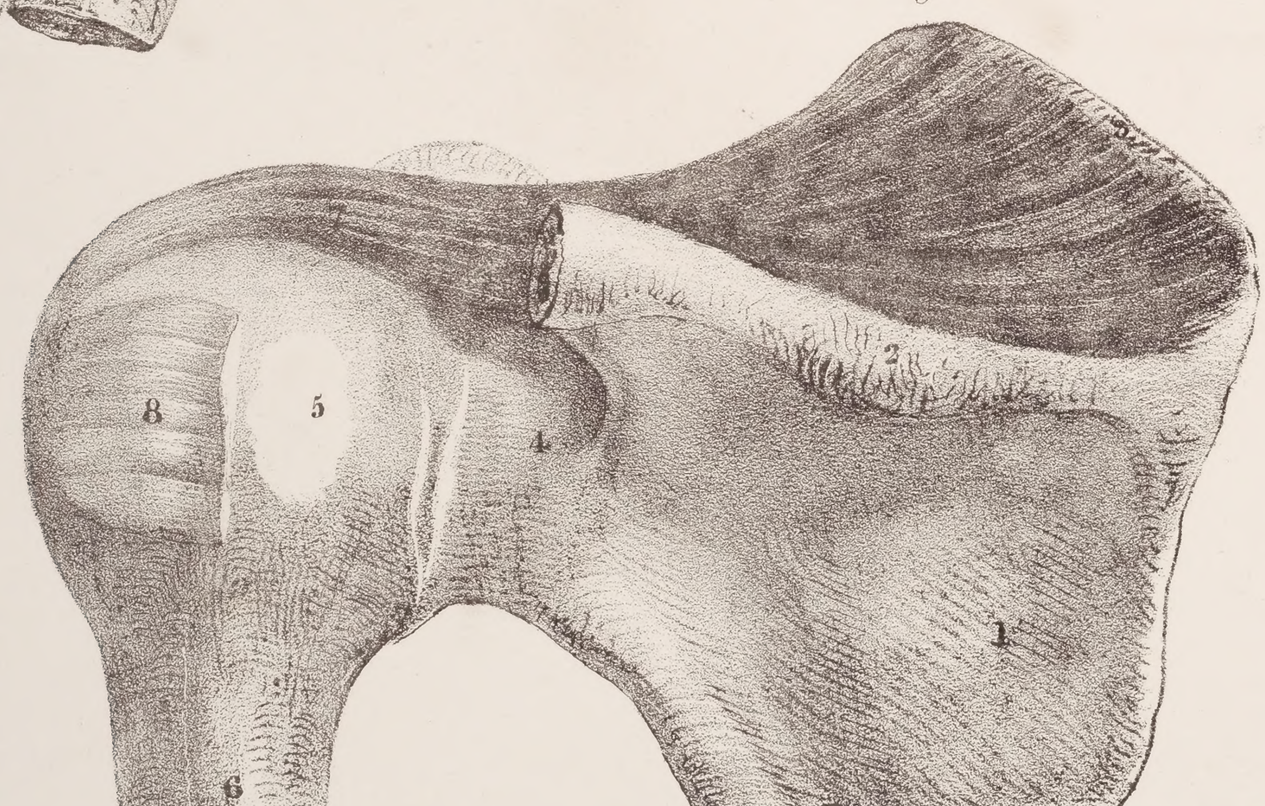

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PLATE XV.

The drawings in this fasciculus are intended to show the muscles which act upon the fore-arm, and bring it forwards, so as to form an angle with the upper arm, and those which carry it back again, so as to bring the whole limb into a straight position. These movements are termed flexion and extension. The elbow-joint is constructed on the principle of a hinge, the movements of the fore-arm upon the arm being limited to those here stated. The two muscles which bend the fore-arm upon the arm, are shown in Plate XV. fig. 1. They are placed upon the fore part of the shaft of the bone. The first of these is placed in the greater part of its extent immediately beneath the skin and the fascia of the arm as is seen delineated in Plate XIII. fig. 1, No. 9. It extends from the scapula down to the radius or outer bone of the fore-arm, and is named the two-headed flexor of the fore-arm (biceps flexor cubiti). This term expresses the fact, that it flexes the fore-arm, and that at its upper extremity it presents two heads or distinct points of attachment: one of these is observed to be fixed to the coracoid process of the scapula conjointly with another muscle which lies along its inner border, and which, from being attached by one end to the process just named, and by the other to the arm-bone about its middle, is named coraco-brachialis; the other head of the biceps runs over the upper extremity of the humerus in a groove which lodges it, and through the capsular ligament of the shoulder-joint, as may be seen in fig. 2, No. 7, its extremity being fixed to the upper border of that shallow pit in the scapula with which the head of the humerus articulates. These parts of the muscle are compressed and narrow; they are here shown of a white colour, for they consist of tendinous fibres. They gradually approach as they descend, forming a very acute angle, and widen somewhat as they become continuous with the fleshy part or body of the muscle, which will be observed to enlarge and swell out, becoming convex and prominent at its middle; but towards the lower part it again narrows, and its fibres run into a tendon which slides over the elbow-joint, and is fixed to a prominent nodule of bone which projects from the inner side of the radius. When the fleshy fibres of the biceps muscle are brought into action, they contract and shorten, by which means its ends are necessarily brought nearer to one another. But, as the upper end is for the most part fixed, the power of the muscle is concentrated upon the lower one, by which means the radius is drawn forward, so as

PLATE XV.

Fig. 1. Shows the two flexor muscles of the fore-arm, and the extensor as seen from the inner side of the limb. The subscapular muscle is also brought into view; to effect which the scapula and arm are detached from their connexions with the body.

No. 1. The acromion process of the scapula. 2. The coracoid process. 3. The upper border of the scapula. 4. Its upper angle. 5. The base. 6. The lower angle. 7. The small tubercle of the humerus. 8. The inner condyle. 9. The outer condyle. 10. The tubercle of the radius. 11. Part of the shaft of the radius. 12. Part of the ulna. 13. Part of the supra-spinatus muscle. 14. The subscapular muscle. 15. Part of the teres minor muscle, deeply shaded where it crosses behind the long head of the triceps muscle. 16. The teres major muscle. 17. Part of the latissimus dorsi muscle. 18. Part of the pectoralis major drawn forwards out of its place. 19. The external or long head of the biceps muscle. 20. The inner or short head arising from the coracoid process, together with the coraco-brachialis muscle, which lies along its inner border. 21. The rounded tapering body of the biceps muscle. 22. Its tendon of insertion into the tubercle of the radius. 23. The posterior or long head of the triceps muscle. 24. Its inner or short head: between the latter and the biceps appears the brachialis anticus muscle, marked 23, but which ought to be 25; its insertion into the coronoid process of the ulna is seen further down.

Fig. 2. Shows the capsular ligament of the shoulder-joint laid open, in order to bring into view the tendon of the biceps muscle—its relation to the head of the bone, and its origin, form the upper border of the glenoid fossa.

No. 1. The hollowed or under surface of the scapula. 2. The coracoid process. 3. The acromion. 4, 5. The globular head of the humerus. 6. The glenoid ligament surrounding the margin of the articular cavity of the scapula, and connected with 7. the tendon of the biceps muscle. 6. Is the shaft of the humerus. 8. The capsular ligament of the joint laid open. 9. The tendon of the biceps after having passed beneath the border of the capsular ligament.

Fig. 3. Exhibits in its entire length the supra-spinatus muscle; the scapula and shoulder joint being viewed from behind.

No. 1. The posterior surface of the scapula. 2. The spine; the acromion is removed where it overlaps the supra-spinatus muscle. 3. The upper part of the base of the scapula. 4. The neck of the bone. 5. The capsular ligament where it covers the head of the humerus. 6. Part of the shaft of the humerus. 7. The supra-spinatus muscle. 8. The insertion of the infra-spinatus muscle into the great tubercle of the humerus.

to form an angle with the humerus. The action of the muscle, however, is not confined to one of the bones of the fore-arm; by a simple piece of mechanism, it is made to extend in effect to the other also; for from the inner border of its tendon a fibrous band is stretched obliquely inwards, and becomes fixed upon the surface of the muscles of the fore-arm. This fact is expressed in Plate XIII. fig. 1, No. 13. By means of this process, and of the connexion which it establishes, whenever the muscle contracts, so as to pull upon the radius, part of its effort is directed at the same time upon the inner side of the fore-arm. Another simple contrivance gives to this muscle an additional power over the radius besides that of flexion. If it were intended to give it the latter power alone, its tendon would have been fixed into the anterior surface of the bone: its fibres, however, are prolonged backwards, and fixed towards the posterior aspect of a nodule of bone which projects from the side of the radius, so that it is thrown inwards from the axis or shaft of the bone. Now, if the radius is rotated inwards, as when we turn the hand and fore-arm prone, the biceps muscle is enabled to rotate it upon its axis, and turn the arm and hand outwards, bringing thereby the palm of the hand from the prone into the supine position.

When we consider the changes which occur in this muscle during its actions, it is obvious that a loss of power results, not only from the mechanical contrivance employed, but also from the circumstance, that part of its force is expended upon the scapula; for when the fleshy fibres contract, they ripple and concentrate themselves towards the middle of the muscle, thereby pulling upon both ends—the upper as well as the lower. But though some force is thus directed away from the fore-arm, it cannot be considered as either lost or misplaced, when we take into account the influence which it exerts upon the state of the limb generally. The power applied in this direction, has the effect of drawing the articulating cavity of the scapula into closer apposition with the humerus, and the latter bone is at the same time prevented from sliding upwards, during the action of the muscle, by which adjustment the humerus is made to constitute a sufficiently steady point of support for the arm-bones. The mechanism by which this is effected will readily be perceived, by looking at fig. 1, in the plate; it shows how an associated movement is established between the three bones—the radius, the humerus and the scapula. Other muscles, as well as the biceps, are concerned in these movements, and are made to perform, either together or separately, various parts in the changes which take place, and in the efforts which are made; it too fulfils its own purposes in the ways here pointed out.

As to the other mode in which power is lost, for it, also, ample compensation is afforded. In the movements of the arm, the radius is made to serve as a lever, the muscles being the moving power by which it is acted on. The fulcrum or point upon which it rests or moves is in the elbow-joint, where the head of the bone rests against the humerus; the resistance is at the opposite end, viz. at the hand, the power being between both, so that it represents a lever of the third order; moreover, in originating the motion, the muscle acts in a direction nearly parallel with the axis of the radius. A loss of power obviously results from this contrivance; but a considerable degree of velocity is acquired in the movements of the limb, which is a sufficient equivalent for the loss.

The biceps muscle has a powerful assistant in the muscle (brachialis anticus) which is placed immediately under it, and part of which is in this plate seen, fig. 1, No. 23, projecting from under its inner border, and extending downwards, to be fixed into the fore part of the ulna at its coronoid process. The muscle extends from the middle of the humerus to the point just named; it commences (see Plate XVI. fig. 1, No. 13, where it is shown in its entire length, the biceps being removed,) just below the insertion of the deltoid muscle, which it in a manner embraces by its bifid extremity, and its fibres take their points of attachment from thence downwards along the surface of the humerus; its insertion is into the fore part of the coronoid process of the ulna. The direct action of the muscle is to draw the ulna forwards on the humerus, thereby conspiring with the biceps muscle in flexing the fore-arm.

The antagonist of the flexor muscles is in part seen in this drawing; it is called the three-headed extensor muscle, (triceps extensor cubiti). The parts which it here presents, are indicated by the figures, 23, 24. It is fully shown in Plate XVI. fig. 2. Its points of attachment and action shall be given in our comments upon the latter.

Two muscles are here shown, which exert considerable influence on the movements of the arm; one of these is seen fig. 1, No. 14, another, No. 16; the former is triangular in its figure, taking the form of the scapula, and under cover of which it is placed, from which circumstance it is called the subscapular muscle. Its fibres are attached by one extremity to that surface of the bone just named where it overlays the ribs, by the other they are fixed to the humerus through the medium of a tendon, towards which they are seen to converge:—the tendon, previously to its insertion into a nodule upon

the bone, called its small tuberosity, is intimately connected with the fibrous capsule of the shoulder-joint. This muscle when brought into action will, in the first instance, press the head of the humerus closely to the articular cavity of the scapula, and continuing its action it rotates the bone inwards, making it to turn upon its axis. The subscapular muscle and the three others which extend to the humerus from the posterior surface of the scapula, and which are seen in Plate XIV. fig. 2, No. 7. 9. 10, are the principal agents in keeping the head of the humerus in its place, as well as in rotating it. The weight of the limb tends constantly to draw it downwards, and the capsular ligament which connects it with the scapula, would be altogether insufficient to sustain it, but for the contractile force and power of these muscles. This is proved by the facility with which dislocations are known to occur, in cases in which paralysis has weakened or destroyed the power of the muscular fibres, and by the readiness with which displacement is known to recur in certain individuals, owing to a state of atony induced by previous dislocation.

Below the subscapular muscle is seen another called the teres major, No. 16, a name which is obviously ill-chosen, for it does not correctly express what its form is; and resting upon it is seen part of the broad muscle of the back, (latissimus dorsi, No. 17). These muscles when put in action can draw the shaft of the humerus inwards to the side, and, if the arm has been previously rotated outwards, their mode of attachment to the humerus is such as to enable them to turn it upon its axis, and rotate it inwards.

Fig. 3, shows the supra-spinatus muscle in its entire extent; the acromion process of the scapula being cut away in order to bring its insertion into view. It extends outwards from the scapula to the large tubercle of the humerus, into which it is fixed by a tendinous insertion. When this muscle is coming into action, it will press the upper extremity of the humerus against the glenoid cavity of the scapula: continuing its effort, it will make the rounded head of the bone slide downwards, and at the same time project its axis outwards from the side, making the bone to pass from the position in which it is seen in fig. 3, to that in which it is placed in fig. 2. Thus when we desire to move the arm from the side and carry it upwards into the horizontal position, this muscle commences the effort and can effect it to a certain extent; but the deltoid is called into action, takes up the movement at a particular point, and continues it until completed.

PLATE XVI.

The coraco-brachial muscle is here shown in its entire length, fig. 1, No. 17, also the anterior brachial muscle, fig. 1, No. 13. In order to expose both of these fully, the biceps muscle has been removed; but the principal object of both figures is to show the extensor muscle, which is placed at the back part of the humerus, for it is opposed in situation, as it is the antagonist in action, to the biceps and anterior brachial muscle. It is called the three-headed extensor muscle, (triceps extensor cubiti) the name being intended to express its action upon the fore-arm, and also because at its upper extremity it has three points or heads. One of these heads is fixed to the lower border of the scapula, immediately behind its articulating cavity. (Fig. 1, No. 15; also fig. 2, No. 15.) At first it is flat and tendinous, but lower down it enlarges and becomes fleshy. The second head lies along the outer border of the bone just noticed; it commences by a pointed tendinous process immediately below the great tubercle of the humerus; the muscular fibres which are placed lower down, commence from the surface of the humerus, to which they are fixed from point to point, even to its lower extremity. The short head lies along the inner side of the first, as may be seen in fig. 1, No. 14. Its fleshy fibres, too, take points of attachment along the surface of the humerus. It would be more correct to say, that in this case as well as in others, the muscular fibres are attached to the periosteum or fibrous investment of the bone, rather than to the osseous texture itself. The muscular fibres here noticed, extend, some directly downwards, others downwards and backwards, and become continuous with the fibres of a broad aponeurosis seen at fig. 2, No. 11, which narrows at its lower part, and is fixed to the posterior surface of the olecranon process of the ulna.

When the fore-arm is brought into a state of flexion by the action of the biceps and anterior brachial muscle, the triceps can readily draw it backwards, so as to bring it again into a right line with the humerus, or, in other words, extend it. If the fore-arm and arm be fixed, the long head of this muscle can move the scapula upon the humerus, and in the extended state of the limb it may assist in drawing the arm backwards.

Dislocations of the elbow-joint.—The bones which form the elbow-joint may be displaced from one another in different directions. The radius and ulna may be thrown backwards behind the humerus, or they may be forced inwards or outwards; but the luxation backwards is the most ordinary occurrence, owing to the manner in which the force is applied. The accident most commonly occurs when a person, in falling forwards, puts out his hands to protect his body. In such circumstances, the palm of the hand comes first to the ground, so that the force of the fall is transmitted to the fore-arm, tending to press the upper ends of the radius and ulna backwards behind the humerus, whilst at the same time the weight of the body presses the lower extremity of the humerus obliquely downwards and forwards. In this way the bones are made to ride one upon the other, their ends being driven by opposing forces in the directions just indicated. There is also something in the structure of the joint which renders this dislocation more frequent than the others; for the coronoid process of the ulna projects but little forwards, and opposes only a slight resistance to the humerus when it is pushed downwards and forwards by the fall. Another form of dislocation occurs, in which the ulna alone is displaced from its connexion with the pulley-like surface of the humerus, and thrown behind it, the radius remaining in its usual position. And lastly, the radius by itself may be forced either forwards or backwards, the ulna remaining in its place. These are the simple dislocations (as distinguished from those that are compound or complicated) which may take place at the elbow-joint; one, however, occasionally occurs which is not included in this list:—it is that form of accident in which the radius and ulna are both dislocated forwards, which is necessarily complicated with fracture of the olecranon process.

When both bones are thrown backwards, the coronoid process of the ulna is lodged in the pit at the lower part of the humerus, so that the olecranon projects backwards, and also much above its usual position. In the natural state of the parts, this process of the ulna is on a level with the external condyle of the humerus; but in its new position, it projects nearly an inch and a half above it. As to the radius, its position is at the back part of the external condyle of the humerus; whilst the last-named bone necessarily forms a considerable prominence at the fore part of the arm. Owing to this change in the relative position of the bones, the shape of the limb at the elbow-joint is greatly altered. There is a considerable projection at the back part, consisting of the olecranon process and the head of the radius; the articular surface of the humerus forms a prominence at the front, but, laterally, there is a depression at each side, corresponding with the borders of the olecranon. Motion is nearly lost; the limb is a little flexed, the fore-arm inclining to the supine position. The anterior ligament of the joint is necessarily torn through; the biceps muscle is somewhat stretched; and the brachialis anticus is considerably so, for it is made to run over the articular surface of the humerus, and then curves backwards to the coronoid process. The triceps muscle, on the contrary, is relaxed, inasmuch as the olecranon process, into which it is inserted, is situated higher up than in its natural condition. When the state of the two flexor muscles is considered, particularly that of the brachialis anticus, it will be obvious that they will begin to assist in drawing the bones forward, as soon as the coronoid process is dislodged from its position in the supra trochlear fossa; to effect this primary object, a simple expedient will suffice. The patient sits on a chair, and the surgeon placing

PLATE XVI.

Fig. 1. Shows the brachialis anticus muscle in its entire extent; and two portions of the triceps are seen from the inner side of the limb.

No. 1. The scapula—its hollowed or under surface. 2. The coraco-acromial ligament inserted into the acromion process. 3. The coracoid process. 4. The lower border of the scapula. 5. The great tubercle of the humerus. 6. The shaft of the bone. 7. The external condyle of the humerus. 8. The head of the radius. 9. Part of the shaft of the radius. 10. The coronoid process of the ulna. 11. The inner condyle of the humerus. 12. Part of the shaft of the ulna. 13. The brachialis anticus muscle. 14. The inner or short head of the triceps muscle. 15. Its long head. 16. A small part of the external head of the triceps, seen in the interstice between the long head and the humerus. 17. The coraco-brachialis muscle.

Fig. 2. Exhibits the triceps muscle in its entire extent, as seen from the back of the limb. The scapula is drawn up in order to put the long head of the muscle on the stretch.

No. 1. The dorsal surface of the scapula. 2. Its lower border. 3. The coracoid process. 4. The large tubercle of the humerus. 5. The small tubercle. 6. The inner condyle. 7. The border of the sigmoid cavity of the ulna. 8. The external condyle. 9. The head of the radius. 10. Part of the ulna. 11. The lower or tendinous part of the triceps muscle. 12. The fleshy body of the muscle. 13, 14. The inner or short head of the triceps. 15. The long head of the triceps muscle. 16. The external head of the muscle.

Plate 16.

Fig. 2.

Fig. 4.

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Plate 17.

Fig: 1.

Fig 2.

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his foot upon it also, rests his knee against the inner side of the elbow-joint in which the dislocation has occurred. He then takes hold of the wrist, and draws the fore-arm forcibly forwards. At the moment of doing this, the pressure of the knee is directed against the radius and ulna, with a view to force them backwards from the humerus; and when this is once effected, the action of the flexor muscles will draw the bones forwards into their natural position. Sir Astley Cooper once reduced a dislocation by the aid of the muscles alone, in the case of a person who had the elbow dislocated backwards, and also laterally inwards: "Finding (to use his own words) that the tendon of the biceps and the brachialis anticus were put upon the stretch, I thought I might make use of them to draw the os humeri backwards, as by the string of a pulley; so I forcibly extended the arm, and the dislocation was immediately reduced."—(On Dislocations, p. 437.) The muscles, under such circumstances, doubtless exercise some influence in pressing the humerus backwards, but their principal force will be made to act in drawing the ulna and radius forwards. When the reduction is effected, the fore-arm should be bent, so as to form an angle somewhat less than a right angle with the upper arm, and should be retained in that position, and supported in a sling. There are various modes of effecting the reduction of this dislocation. It is a common practice to place the patient beside a bed-post, round which he places his arm; the fore-arm is then drawn steadily forwards, and at the same time bent, but the upper-arm must necessarily be fixed, else the counter-extension will not be adequately maintained: again, the counter-extension may be made by an assistant, who takes hold of the middle of the arm, whilst another assistant makes extension from the wrist. In the dislocation backwards, it sometimes happens that the annular ligament, which retains the head of the radius in apposition with the side of the ulna, is torn, so that when the chief dislocation is reduced, the radius has a tendency to slip out of its place, and pass before the ulna. If such an accident should take place, it must be dealt with as if it were a primary dislocation of the radius forwards, which we shall notice in the sequel.

The bones of the fore-arm may be thrown inwards or outwards, constituting the lateral dislocations; these are commonly the consequence of considerable force or violence, for none of the

PLATE XVII.

The muscles at the front of the fore-arm are exhibited in these drawings; the superficial set, those which lie immediately under the skin and fascia, are represented in Fig. 1. In Fig. 2, some of these are removed in order to bring others into view, which they in part conceal.

Fig. 1, No. 1. The lower part of the biceps muscle. 2. Its tendon; at its inner edge is seen part of the aponeurosis given off from the tendon, and which, when prolonged inwards, covers the brachial artery and median nerve. 3. Its insertion into the tubercle of the radius. 4. The lower part of the brachialis internus muscle projecting at each side of the tendon of the biceps. 5. Part of the triceps muscle. 6. The fleshy fibres of the brachialis anticus muscle. 7. The pronator radii teres muscle. 8. Its lower part becoming tendinous as it approaches the radius. 9. The flexor carpi radialis muscle. 10. Its tendon. 11. The continuation of the same into the palm of the hand. 12. The palmaris longus muscle. 13. The termination of its tendon in the annular ligament and palmar fascia. 14. The tendon of the flexor carpi ulnaris muscle, which is seen running along the inner border of the fore-arm. 15, 15. The fleshy fibres of the superficial flexor muscle of the fingers; the tendons of this muscle are drawn a little to the inner side in order to expose, 17, the tendons of the deep-seated flexor muscles. 16. Part of the pronator quadratus muscle. 18. The anterior annular ligament of the wrist. 19. The palmar fascia. 20. Metacarpal bone of the thumb. 21. The small muscles of the little finger. 22. The abductor muscle of the index finger; the muscles of the thumb having been removed in order to expose it. Along the outer side of the fore-arm, extending from above the elbow down to the end of the radius, is seen the supinator longus muscle. At its upper part it is fleshy, but lower down it ends in a flat narrow tendon, which is inserted into the outer border of the radius, a little above its styloid process; the point of attachment of the tendon is overlapped and concealed by the tendons of two of the abductor muscles of the thumb; between the tendon of the supinator muscle and that of the flexor carpi radialis (10), is seen a part of the long flexor muscle of the thumb.

Fig. 2, No. 1. The lower part of the humerus. 2. The inner condyle. 3. The inner side of the trochlea. 4. The olecranon process. 5. The superficial flexor muscle of the fingers. 6. Its tendons prolonged downwards to the palm of the hand. 7. The flexor carpi ulnaris muscle. 8. Its tendon of insertion; this muscle at its upper end presents two pointed processes by which it is attached to the inner condyle of the humerus, and the olecranon process of the ulna; between these is an angular interval, through which passes the ulnar nerve; some transverse fibres are observed to pass across from the one to the other. 9. The tendon of the abductor muscle of the metacarpal bone of the thumb. 10. The lower extremity of the radius. 11. The tendon of the long flexor muscle of the thumb. 12. The lower extremity of the ulna. 13. The insertion of the tendon of the flexor carpi ulnaris muscle into the pisiform, or pea-shaped bone. 14. Part of the anterior annular ligament of the wrist.

ordinary movements of the arm tend to favour their production, and their occurrence is opposed by the mode of adaptation which exists between the articulating surfaces of the bones. It should also be observed, that these dislocations are seldom complete, which is owing, no doubt, to the great extent of the articulating surfaces in the transverse direction. The accident has been produced by the arm being accidentally caught between the spokes of the wheel of a carriage as it rolled along, by which means the fore-arm was drawn outwards, and the upper-arm inwards; it has been produced also by the passage of a wheel over the arm of an individual who had fallen with the limb outstretched. In either case, the lateral ligaments of the joint are torn, and those upon the front and back part are partially, if not entirely so. The fibres of the muscles, too, suffer more or less injury; hence it is that the limb seldom presents that fixity which exists in the posterior dislocation. When the bones of the fore-arm are thrown outwards, the coronoid process will rest against the back part of the external condyle of the humerus, so that the olecranon forms a greater projection than it does in the dislocation backwards. The head of the radius necessarily lies behind, and to the outer side of the humerus, where it can be readily felt by rotating the hand. At the inside of the articulation the condyle of the humerus forms a projection, and there will necessarily be a depression above the one and beneath the other of these prominent points. When the bones are thrown inwards, the olecranon process will rest against the back part of the inner condyle of the humerus, where it forms a considerable projection. The head of the radius corresponds with the posterior fossa of the humerus, which ordinarily receives the olecranon. In such circumstances, the external condyle of the humerus is rendered very prominent at the outer side of the joint, and beneath it there is a depression, owing to the retrocession of the head of the radius; at the inner side of the limb there is a depression also, but it is above the end of the olecranon. These circumstances, together with the inclination of the hand and arm outwards, coupled with the want of power and of motion in the limb, constitute the distinguishing characters of the accident. In whatever direction the dislocation has occurred, the reduction is easily effected by making counter-extension from the arm and extension from the wrist; there being little resistance to overcome, save what is offered by the friction of the projecting ends of the bones against one another. Or the expedient above indicated, in the case of the dislocation backwards, may be resorted to, viz. that of "bending the arm over the knee, even without particularly paying attention to the direction of it, inwards or outwards; for as soon as the radius and ulna are separated from the os humeri, by the pressure of the knee, the muscles will give them the proper direction for reduction."—(Op. cit. p. 436.)

PLATE XVII.

Some of the muscles of the fore-arm are brought distinctly into view as soon as the skin and fascia are removed, others are placed more deeply; the two figures in this plate indicate the fact. Several of the muscles are attached to the prominent points of the humerus, so that one group will be observed to arise from the inner condyle of that bone, and another from the outer condyle. In the interval between these the biceps and brachialis anticus muscles are seen to dip down in order to reach their points of attachment to the radius and ulna. Into this interval also the brachial vessels descend as they are passing from the arm into the fore-arm. The names of the muscles express their ordinary actions and uses; one is observed to stretch obliquely from the inner condyle, downwards and outwards, to the middle of the radius, fig. 1—7, 8. It is called the pronator of the radius (pronator radii teres), for it can turn the radius upon its axis, so as to place the fore-arm and hand in the prone position, if it has been previously in the opposite state. If, after having effected so much by its contraction, it be made to continue its efforts, it will assist in drawing the fore-arm forwards, so as to place it in the flexed position. There is one case in which it may be even in the first instance a flexor muscle, viz. if the supinator muscles are previously put into action so as to prevent it from rotating the radius. Along the inner side of the muscle here noticed, lies another, which is considerably longer, as it extends from the inner condyle to the metacarpal bone of the fore-finger. The tendon, which is prolonged from its fleshy fibres, passes under the anterior annular ligament of the wrist, and slides through a groove in the trapezium bone, previously to reaching its insertion. It is called the radial, or outer flexor muscle of the wrist (flexor carpi radialis), not because it runs along the radial border of the arm, but merely from its direction towards the radial, or outer side of the hand, upon which it is made to act. The tendon of this muscle serves as the guide to the position of the radial artery in the

ordinary operation of feeling the pulse at the wrist. Along the inner or ulnar border of the flexor radialis, lies a thin small muscle, which is prolonged to the annular ligament and palmar fascia, in which its tendon (13) terminates; hence it is termed palmaris longus: in many subjects it does not exist. Along the inner border of the fore-arm, and taking the direction of the ulna in its entire length, is placed the flexor carpi ulnaris muscle; its tendon (No. 14), and part of its fleshy fibres, are seen in fig. 1, but in fig. 2 it is fully shown; its fleshy fibres (No. 7) proceed obliquely forwards from the ulna to reach the tendon, which lies along the fore part of the muscle. Its upper extremity is attached by two distinct points to the inner condyle and the olecranon process, in the interval between which the ulnar nerve is placed, as it proceeds to the fore-arm. The superficial flexor muscle of the fingers is seen only at two points (15, 15) in fig. 1, as it is overlaid by the other muscles; but in fig. 2 it is brought more fully into view by their removal. At the outer border of the fore-arm is placed a long muscle, with a considerable fleshy body, which ends in a flat tendon; it is called the long supinator of the radius, to distinguish it from another muscle possessed of a similar power, but which is deeply placed at the upper part of the fore-arm: underneath the long supinator are two extensor muscles, which are in great part concealed by it.

Now, when we consider the power of these muscles, it is obvious that they can be made to act upon the bones of the fore-arm, the hand, and the fingers; the action of the pronator teres has been already noticed; the flexors of the wrist, as their name implies, can draw the hand forwards so as to bend it upon the fore-arm. The flexors of the fingers pull on their tendons like so many cords, and curve the joints so as to close the hand; and having proceeded so far, they can be made to act upon the wrist too, and flex it upon the fore-arm. The pronator muscle is directly assisted in its action on the fore-arm, by a short square plate of muscular fibres stretched across from the radius to the ulna, close to their lower extremities: from its shape it is called pronator quadratus, by which it is distinguished from the other, which is named "teres," or round. The direct antagonists of the pronator muscles are the long and the short supinators, of which the former alone is seen in this plate; the biceps muscle, it will also be recollected, has a similar power over the radius.

The head of the radius may be displaced from its natural position, and thrown either backwards or forwards: of the latter dislocation Sir Astley Cooper met with six instances, but none of the former in the living subject. He had, however, an opportunity of examining the state of the joint in the dead body of a man brought for dissection to St. Thomas' Hospital, in whom this dislocation existed, without being reduced, for a considerable time previous to his death. The coronary ligament was torn through at its fore part, the oblique one had also given way. The "capsular ligament was partially torn, and the head of the radius would have receded much more, had it not been supported by the fascia, which extends over the muscles of the fore-arm." When the arm was extended, the head of the radius could be seen as well as felt behind the external condyle of the os humeri. Professor Langenbeck, of Gottingen, met with two cases of this accident; in one, a man twenty years of age, it was of six weeks' standing; in the other, a child five years old, it had occurred on the day previous to his admission into the hospital. The symptoms in both were so well marked, that the nature of the injury became manifest, even on the first inspection. The peculiar form of the radial side of the fore-arm, owing to the ulna not being displaced, indicated the nature of the mischief. At the origin of the supinator radii longus, and the extensors carpi from the external condyle, there was a marked prominence; the outline of the arm was somewhat like that which exists in rickety persons, in whom the radius is generally bent. On examination of the joint, the head of the radius was found thrown backwards and outwards from the external condyle of the humerus, and could be immediately detected. The hand was prone, and could not be brought into the state of supination. The fore-arm was moderately bent, in which position it was fixed, for the arm admitted neither of flexion nor extension. At the inner side of the internal condyle the skin was loose, and presented a depression, in which the internal articulating surface could be felt. On tracing the radius from below, upwards, the finger came against the external condyle, behind which, in the adult, the articular surface only of the radius could be felt, and next to it the olecranon. When the finger was placed on this spot, and the radius was moved as far as it admitted, its motion was distinctly felt. In the other case, the glenoid cavity of the head of the radius could be felt behind and beneath the external condyle of the humerus. In the child, moderate extension only, with pressure on the end of the radius, sufficed for its reduction. In the adult, though the dislocation was of such long standing, it was reduced also. The "principal means to be adopted appeared to me, a powerful but gradual extension of the fore-arm, in order to draw the head of the radius towards the articulating surface of the humerus; at the same time making counter-

extension at the upper arm, I pressed the dislocated head inwards. As in this case very strong and long-continued extension was necessary, I could, after a while, completely stretch out the fore-arm, which was before impracticable, and thus push the head of the radius inwards. The limb was kept in this situation by splints and bandages, and the patient was soon able to move the fore-arm in the four directions."—(Lancet, 1827, Vol. I. p. 248.) Though the extension was made from the fore-arm, in these cases it succeeded. In the first instances of the dislocation of the radius forwards which Sir A. Cooper met with, the efforts failed, even though long continued, as the force was expended for the most part on the ulna, which remained in its natural position. On considering the subject, it became obvious that this defect in the means of reduction could be remedied by making extension from the hand, for then all the force would be concentrated upon the radius.

Boyer never met with the dislocation of the radius forwards, and expresses doubts of its ever occurring. Sir Astley Cooper reports six cases of this form of accident. It was produced, at least in some of these, by a fall upon the hand with the arm extended; the radius received, under such circumstances, the weight of the body, and was forced upwards and inwards so as to get in front of the coronoid process of the ulna. When this accident occurs, the fore-arm is slightly bent, but cannot be brought to a right angle with the upper arm, nor can it be completely extended. When it is suddenly bent, the head of the radius strikes against the fore part of the os humeri, and checks the motion. The hand is in the half-supine position. If the thumb be pressed into the middle of the bend of the elbow, the head of the radius can be felt, particularly if it be slightly rotated. "On dissection, the head of the radius is found resting in the hollow, above the external condyle of the os humeri; the ulna being in its natural position. The coronary ligament of the radius, the oblique ligament, and the anterior ligament of the elbow joint, are torn through. The biceps muscle is shortened."—(On Dislocations, p. 440.)

PLATE XVIII.

The deep-seated muscles of the fore-arm and hand are here brought into view by the removal or displacement of the superficial set which conceal them.

Fig. 1, No. 1. Internal condyle of the humerus. 2. The external condyle. 3. The fleshy part of the biceps muscle. 4. The brachialis anticus muscle projecting to the inner side of the biceps. 5. Part of the triceps extensor muscle. 6. The insertion of the brachialis anticus into the coronoid process of the ulna. 7. The supinator radii brevis muscle. 8. The superficial flexor muscle; its attachment above is to the inner condyle of the humerus, lower down its fibres are fixed to the radius; sometimes a pointed process, as here, is derived from the coronoid process of the ulna. 9. The tendons of the superficial flexor muscle, which are placed closely together, but diverge to their insertions after having got into the palm of the hand. 10. The long flexor muscle of the thumb. 11. Its tendon. 12. A few fibres of the pronator quadratus muscle. 13. The flexor carpi ulnaris. 14. Its tendon. 15. The muscles of the little finger. 16. The muscles of the thumb. 17. Its adductor muscle. 18. Part of the abductor of the index finger. 19. The sheaths which bind down the flexor tendons. 20. The sheath laid open in order to expose the tendon. 21. The tendon of the superficial flexor muscle at its insertion into the second bone of the fore-finger. 22. The tendon of the deep flexor muscle, after having passed through the fissure and groove in the superficial flexor, is prolonged to the last bone of the finger.

Fig. 2, No. 1. The inner border of the humerus. 2. The inner condyle. 3. The olecranon process. 4. Part of the brachialis anticus muscle. 5. The pronator radii teres muscle, which is here drawn forcibly out of its position, in order to show its two origins, and the interval between them; one being from the inner condyle, the other (No. 6) from the coronoid process of the ulna. 7. Some fibres of the supinator radii brevis muscle. 8. The long flexor muscle of the thumb. 9. Its tendon. 10. The deep-seated flexor muscle of the fingers. 11. Its tendons. 12, 12. The two extremities of the pronator quadratus muscle seen where they project beyond the preceding muscles. 13. The muscles which form the ball of the thumb. 14. Its abductor muscle. 15. The abductor of the index finger. 16. The muscles of the little finger. 17, 17, 17, 17. The sheaths which bind down the flexor tendons laid open and inverted. 18. The tendon of the superficial flexor muscle remaining in its position. 19, 19, 19, 19. The tendons of the deep flexor muscle running on to their insertion into the last bones of the fingers.

Plate 18.

Fig. 1.

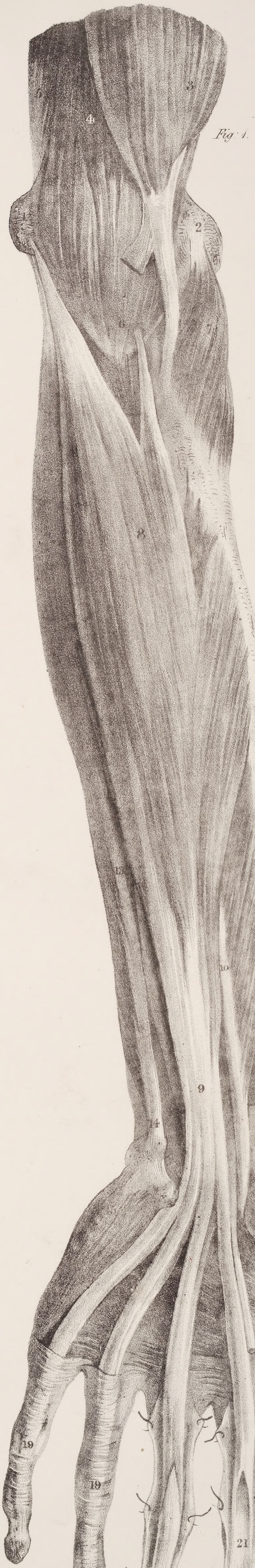

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Plate 19.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

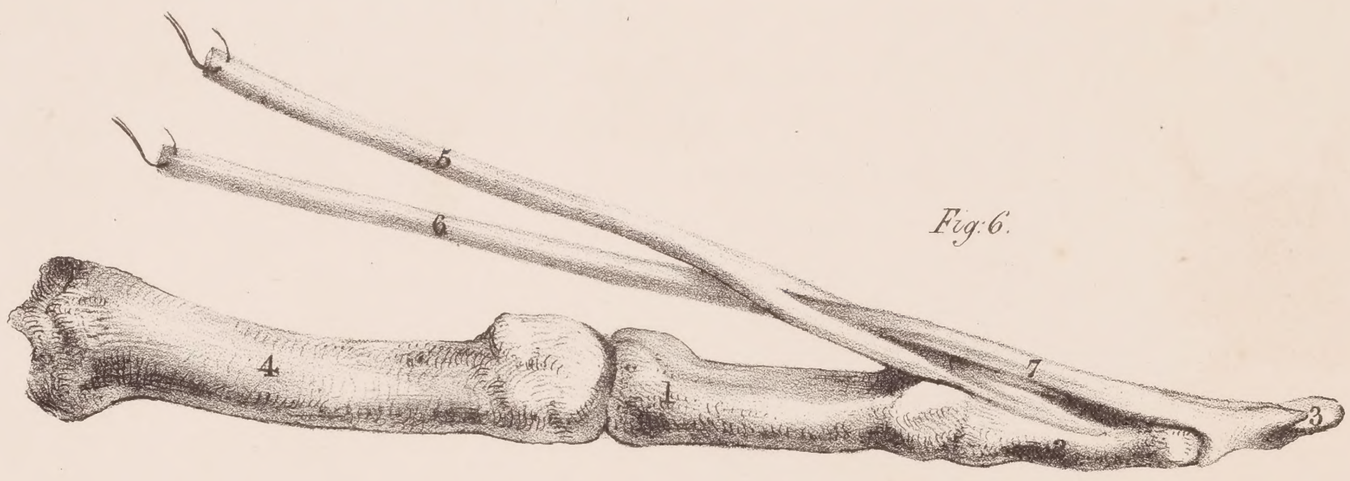

Fig. 7.

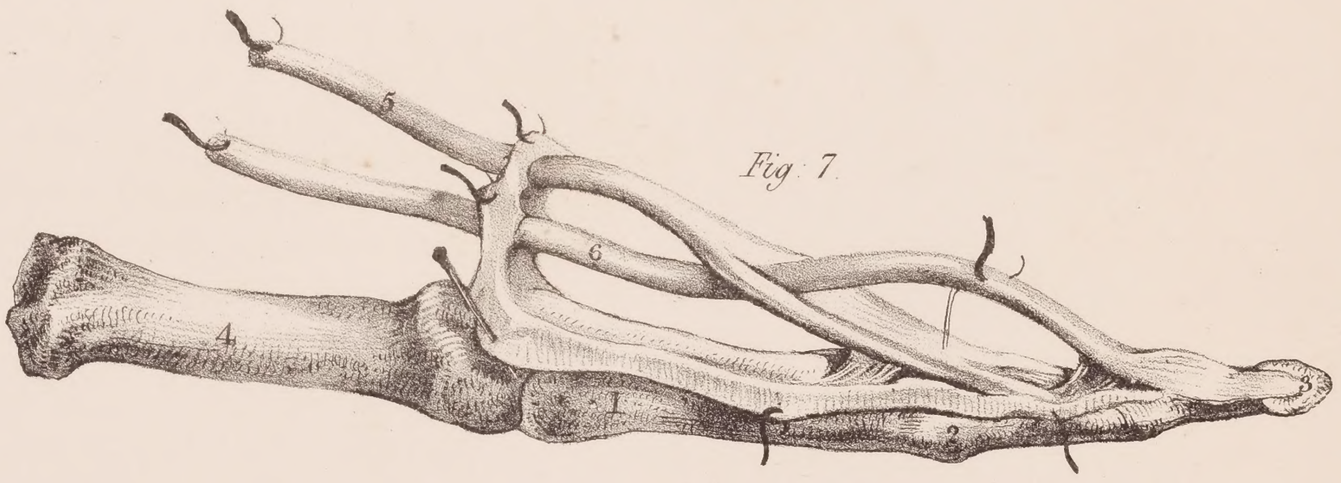

Fig. 9.

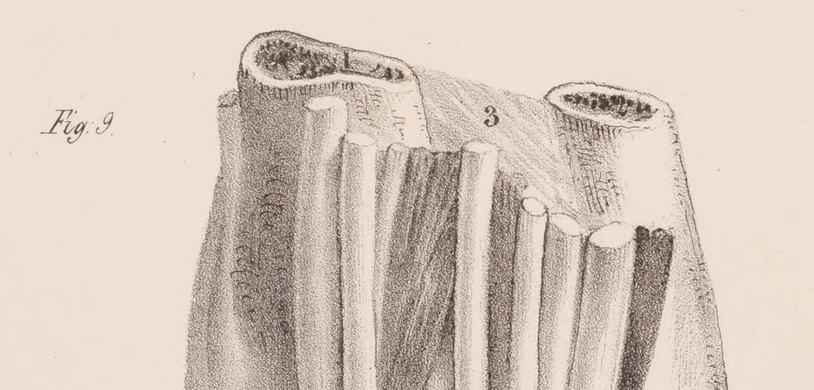

Fig. 8.

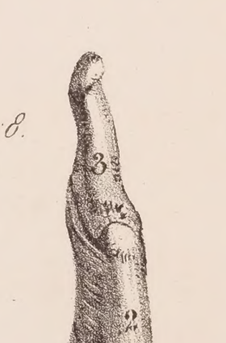

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PLATE XIX.

The first drawing in this plate shows the two pronator muscles of the fore-arm, and the short supinator, all the other muscles being removed, in order that the mode of action of those just named may be more clearly perceived. Having already noticed the pronator teres, and its action, it will suffice here to say, that it is assisted in the effort of turning the hand and fore-arm into the prone position by the flat square muscle placed immediately above the wrist, in close contact with the radius and ulna, No. 7; from its form and its action it is named pronator quadratus. The direction of its fibres is transverse, being extended outwards from the border of the ulna to that of the radius; when in action, they take their fixed point of attachment at the ulna, and then by drawing on the radius, they make it rotate upon the ulna as a fixed point, and so bring it and the hand into the prone position.

The short supinator muscle, which is seen here, No. 3, is the direct antagonist, as its name implies, of the pronators; its fixed points of attachment are the external condyle of the humerus, the external lateral ligament of the elbow-joint, and a ridge upon the posterior surface of the ulna. The fibres of the muscle are directed from these points downwards and forwards, lying close upon the radius, to which they become inserted along an oblique line which extends from the bicipital tubercle down to the insertion of the pronator teres. When the hand and the fore-arm are placed in the prone position, this muscle, by means of the obliquity of its fibres, and by having its fixed points of attach-

PLATE XIX.

Fig. 1, No. 1. The lower extremity of the os humeri. 2. The pronator radii teres muscle. 3. The supinator radii brevis. 4. The ulna. 5. The radius. 6. The interosseous ligament. 7. The pronator quadratus muscle. 8. Part of the tendon of the supinator radii longus muscle. 9. The carpus. 10. The pisiform bone.

Fig. 2. One of the tendons of the deep flexor muscle (flexor digitorum profundus) detached from its connections so as to show its insertion into the last bone of the finger. No. 1. The flexor tendon. 2. The second bone, or phalanx of the finger. 3. The last bone of the finger. 4. The insertion of the tendon into its base.

Fig. 3. No. 1. The deep flexor tendon seen at its posterior aspect. 2. The articulating extremity of the last bone of the finger.

Fig. 4. One of the superficial flexor tendons, detached from its connections, so as to show the mode in which each of them is inserted into the second bone of the fingers, and also the fissure in its fibres, for the transmission of the deep flexor tendon. No. 1. A tendon of the superficial flexor muscle (flexor sublimis perforatus—m. fléchisseur superficiel.) 2. The fissure through which the perforating tendon is transmitted. 3. The groove upon its palmar surface upon which the perforating tendon slides. 4. The second bone of the finger into which the perforated tendon is inserted by two pointed processes. 5. The third bone of the finger.

Fig. 5. The perforated tendon detached from all its connections, as seen at its posterior aspect. No. 1. The tendon previous to its bifurcation. 2. The groove which it presents at its posterior surface, by which it is accommodated to the deep flexor tendon. 3. The fibres of the tendon united again, after having diverged to form the fissure. 4. Their ultimate subdivision into two pointed processes at their insertion into the second bone of the finger.

Fig. 6. The two flexor tendons as they proceed to their points of insertion. No. 1, 2, 3. The first, second, and third bones of the finger. 4. The metacarpal bone. 5. The perforated tendon of the flexor muscle. 6. The deep, or perforating tendon. 7. The same continued onwards to its insertion.

Fig. 7. The flexor tendons as seen when the sheath is laid open which binds them down in their situation; the references are the same as in the preceding.

Fig. 8. Gives a lateral view of the flexor tendons and of their sheath. No. 1, 2, 3. The bones of the finger. 4. The metacarpal bone. 5. The fibrous sheath which binds down the flexor tendons. 6, 7. The superficial and the deep flexor tendons.

Fig. 9. The flexor tendons are here shown as they pass from the fore-arm into the hand through the canal formed for them by the anterior annular ligament and the carpal bones. No. 1, 2. The radius and ulna. 3. The interosseous ligament. 4. The anterior annular ligament cut through at its middle and drawn aside, the ends being held apart by hooks. 5. The pisiform bone. 6. The metacarpal bone of the thumb. 7. The metacarpal bone of the little finger. The flexor tendons form a cluster, and are in a manner compressed together under the annular ligament. Upon their surface rests a delicate synovial membrane, which is prolonged upwards and downwards a little; upon them its points of reflection are distinctly indicated.

ment above and behind, is enabled to act on the radius, making it to turn upon its axis so as to pass from the prone to the supine position. It will be obvious, even from a cursory inspection of these muscles, that they must tend to displace the pieces of the radius in cases of fracture in that bone. When the accident occurs towards the upper part, the pronator will tend to draw the lower piece forwards, whilst the supinator carries the upper fragment somewhat backwards. If the fracture occurs at the lower part, the pronator quadratus, by reason of its transverse direction, approximates the bones when both are fractured, or draws the radius to the ulna when the former alone has suffered injury; and if this tendency on the part of the muscle be not prevented by placing the limb in a proper position, and by a careful adaptation of the fractured pieces, false anchylosis will be very likely to occur.

The other figures in this plate exhibit the arrangement of the flexor tendons of the fingers, their points of attachment to the bones, their mutual adaptation the one to the other, the provisions devised for facilitating their movements by diminishing friction, and for securing their power without increasing their bulk. The flexure, or bending of the different joints of the four fingers, is effected by means of two muscles (flexor sublimis and profundus) which are seen in plate 18, fig. 1, No. 8; fig. 2, No. 10. From each, four cords or tendons are prolonged into the palm of the hand, where they diverge a little from one another towards the fingers; two tendons proceed to each finger, one derived from the superficial, the other from the deep flexor, both being in close contact, as seen in plate 19, fig. 8. As they run along the palmar surface of the bones of the fingers, they are retained in their position by a sheath of fibrous structure, which is stretched from one border of the finger bones to the other, so as to bind them down. When the sheath is cut open and reflected, as in fig. 7, so as to bring the tendons into view, that of the deep flexor will be found to run on to the last bone of the finger, whilst the superficial one is fixed to the second bone, fig. 6, 7, No. 6. The palmar surface of the first and second bones of each finger is slightly grooved, and in the natural condition of parts that groove is converted into a canal by the fibrous sheath above noticed, which is attached along the edges of the bones, and stretched over the two tendons, fig. 8; the fibres of this sheath are closely aggregated together, opposite the central parts or bodies of the bones, but towards their extremities, where they form the joints, the fibres become thin and scattered, so as not to impede or restrict motion. The surfaces of the tendons and of the sheath are lined by a synovial membrane, which secretes a fluid necessary to keep them at all times smooth and pliant. The contrivance adopted to permit the deep flexor tendon to pass beyond the superficial one deserves attention. The fibres of the latter separate into two narrow bands opposite the first bone of the finger, so as to leave between them an angular fissure; they soon unite again (fig. 4, 5) and proceed onwards, to be inserted by two pointed processes into the second bone of the finger. The deep flexor tendon, fig. 6, 7, No. 6, passes through the fissure here noticed, and is continued onwards to its insertion into the last bone. From this circumstance it is that they are called—the one, flexor perforatus; the other, flexor perforans: this, however, is not all; the superficial tendon is grooved at its posterior aspect, where it forms the fissure, for at that point it rests upon the other tendinous cord, but farther on it is grooved upon its palmar or anterior surface, so as to accommodate itself to its new relation to the perforating tendon, which at this point lies upon it.

Fig. 9 is intended to show the provision adopted for facilitating the movement of the flexor tendons, one upon the other. They are compressed closely together as they pass under the annular ligament of the wrist: in this situation, a thin synovial membrane invests them, capable of secreting a fluid which smoothens their surface; it extends upwards and downwards a little; the points of its reflection are here distinctly seen: one membrane is common to the different flexor tendons of the fingers; the long flexor of the thumb has a synovial sheath distinct from the others. In order to expose the tendons and their synovial sheath, the anterior annular ligament is cut through at its middle, and reflected; this thick strong fibrous band is stretched across from the pisiform bone, and the projecting process of the unciform to the scaphoid and the trapezium; and after being fixed into the latter, some of its fibres are continued onwards, so as to form a sheath for the flexor carpi radialis muscle. Its upper border gives attachment to the fascia of the fore-arm; the lower gives attachment to the palmar fascia; from its anterior surface towards its inner border several of the fleshy fibres of the muscles of the little finger arise, and at its outer border some of those of the thumb. This ligament forms half a ring, or canal (the remaining half being made up by the carpal bones) of an elliptic form, which transmits the flexor tendons of the fingers and of the thumb, also the median nerve.

The ulna may be dislocated by itself at the elbow joint, or at the wrist, without any displacement of the radius, notwithstanding the intimate connection which exists between these bones at their

extremities, as well as along their shafts. When the sigmoid cavity of the ulna is separated from the trochlea, or pulley-like surface of the humerus at the elbow-joint, and when the radius still remains in its position, the fore-arm and hand are much twisted inwards, giving rise to a considerable degree of deformity. The arm cannot be extended completely, nor can it be bent to more than a right angle. By tracing the line of the ulna from below upwards, the olecranon will be found prominent, behind the humerus, projecting higher up than its proper position; but the radius will be found before the external condyle of the humerus. These circumstances, taken together with the twisting of the arm inwards, will determine the nature of the accident. In a case of this sort, which had remained a long time unreduced before the death of the individual, the coronoid process of the ulna was found on dissection to have been lodged in that pit at the back part of the humerus which receives the olecranon when the limb is extended; the olecranon projected considerably behind the humerus; the radius was in a manner hitched upon the external condyle of the humerus, where a new joint was formed for it, which admitted of some rotatory motion; the orbicular and oblique ligaments were ruptured, and also some fibres of the interosseous ligament. The brachialis anticus muscle was stretched over the extremity of the humerus; the triceps was of course relaxed. This dislocation may be reduced by resorting to the expedient which is practised in cases of dislocation of both bones backwards, viz. that of bending the arm over the knee, and drawing the fore-arm downwards. As soon as the coronoid process of the ulna is dislodged from the fossa into which it is thrown, the brachialis anticus muscle will direct the bone into its proper position.

The lower extremity of the ulna may be separated from the radius, and be thrown either backwards or forwards. Most writers now agree in considering this accident as a dislocation of the ulna, though it arises from a twisting of the radius, and the force which produces it is applied to the latter bone, or to the hand, causing in effect a displacement of the radius from the ulna. In cases of dislocation of the lower end of the ulna backwards, which more frequently occurs than that in the opposite direction, the fore-arm and hand are in a state of forced pronation, the shaft of the radius instead of being in a line with that of the ulna, crosses it in front at an acute angle, so that the breadth of the fore-arm at its lower part is much diminished; the fore-arm and the hand are somewhat flexed, and the tendons of the flexor muscles pressed inwards present a peculiar appearance along the inner side of the radius, and the lower end of the ulna forms a considerable prominence at the back of the hand, so that it is no longer on a level with the cuneiform bone, nor is its styloid process in a line with the metacarpal bones of the little finger. In the dislocation forwards the same sort of narrowing of the limb and crossing of the bones exist, but in a less degree; the ulna is on a plane anterior to the radius, the fore-arm and hand are necessarily placed in a state of fixed supination; the flexor tendons are pressed outwards, and the lower extremity or head of the ulna forms a prominence at the fore part of the wrist. This dislocation has been caused from a violent twist, or a wrenching movement given unexpectedly to the hand, by which it is turned outwards suddenly into the supine position. The pain, the deformity, the position of the limb, and the projection of the ulna, leave no doubt as to the nature of the accident. The dislocation backwards may be produced by a sudden wrenching or twisting movement in the opposite direction, by which the hand and fore-arm are brought into the state of forced pronation. It occurred in this way to a laundress, whose case Desault has recorded. She was engaged in wringing or twisting clothes with another woman, and whilst in the act she twisted the wrist so violently forwards as to produce the luxation of the head of the ulna backwards. The accident may also be produced by a force applied to the hand whilst falling. Boyer gives the dissection of a case of dislocation of the end of the ulna forwards, which had remained unreduced for some time before the death of the individual. In front of the lower part of the fore-arm a hard prominence was observed, and a depression at the opposite point. This attracted attention, and suggested the expediency of examining it carefully. The hand was œdematous; the flexor tendons were pressed outwards, and had become adherent to one another and to the skin; the sigmoid cavity of the radius was filled up by a new deposit, occupying the place of the cartilage which naturally covers it; the triangular fibro-cartilage which connects the radius with the ulna was torn from the latter bone, and accompanied the radius in its movement backwards; the head of the ulna lay on a plane anterior to the sigmoid cavity of the radius, and rested upon a sesamoid bone, with which it was connected by a capsular ligament. In attempting the reduction of these dislocations, it is necessary, in the first place, to lessen the pressure which the end ulna makes against the radius, before any attempt is made to force it in its proper position. The patient being placed sitting on a chair, an assistant steadily supports the fore-arm, and another the hand; the surgeon then placing

himself at the outside of the limb, takes hold of its lower part with both hands, placing them in such a way upon it that the thumbs shall meet at the interosseous space, and at that side of it towards which the dislocation has occurred, viz. in front, where the dislocation of the ulna has taken place forwards, and *vice versâ*. He then makes an effort to draw the bones in opposite directions, as if with a view to separate them from one another; and as soon as he finds them to give way a little, the assistant who holds the hand endeavours to turn it into the supine position, in the case of dislocation backwards, whilst the surgeon presses the head of the bone with both his thumbs forwards. When the bone is dislocated forwards, the same plan is followed; the movements, with a view to its restoration, being made in the opposite direction.

The radius and ulna may be displaced from their connection with the carpal bones in either of four directions, viz. backwards, forwards, or laterally to either side. The first two occur much more frequently than the others, which is partly owing to the circumstance that the extent of articulating surface is less from before backwards than from side to side, but chiefly because the greater number of efforts which we make tend to throw it backwards or forwards, and not inwards or outwards: owing to this latter cause, and also to the extent of the articular surfaces in the tranverse direction, the lateral dislocations are almost always incomplete. When in falling, a person puts out his hand to save himself, and strikes with the palm against any resisting body, the rounded surface formed by the bones of the carpus is made to slide from behind forwards, so as to press against the anterior ligament of the wrist joint. If the force be considerable, the ligament will give way, and the carpal bones will be pressed forwards, so as to get before the lower extremity of the radius. In this case the hand inclines backwards, being in a state of unnatural extension; but the fingers are flexed. The carpus forms a

PLATE XX.

The first and second planes of muscles, situated at the back of the fore-arm and hand, are seen in these drawings. The outline of the limb is traced by a line indicating the section of the skin, with a view to render its appearance more natural.

Fig. 1, No. 1. The olecranon process of the ulna. 2. The external condyle of the humerus. 3. The triceps extensor muscle (its tendon into which the fleshy fibres are seen to pass obliquely backwards). 4. Part of the flexor muscles — the biceps and brachialis anticus. 5. The long supinator muscle (supinator radii longus). 6. The long radial extensor muscle (extensor carpi radialis longior). 7. The short radial extensor muscle (extensor carpi radialis brevior.) 8. The anconeus muscle. 9. The internal or ulnar flexor muscle of the wrist (flexor carpi ulnaris): its attachment by aponeurotic fibres along the inner border of the ulna is here shown. 10. The lower part of the ulna. 11. The lower part of the radius. 12. The common extensor muscle of the fingers (extensor digitorum communis). 13. The extensor muscle of the little finger (extensor digiti minimi). 14. The inner or ulnar extensor muscle of the wrist (extensor carpi ulnaris). 15. The long abductor muscle of the thumb, or the extensor of its metacarpal bone (extensor ossis metacarpi pollicis). 16. The short extensor of the thumb, or the extensor of the first phalanx (extensor primi internodii pollicis). 17. The tendon of the long extensor of the thumb—in the fore-arm it is covered by the common extensor muscle of the fingers. 18. The tendons of the two muscles of the thumb (15, 16) running together along the outer border of the wrist. 19. The tendon of the short radial extensor at its insertion into the third metacarpal bone. 20. The tendon of the long radial extensor muscle at its insertion into the second metacarpal bone. 21. The tendons of the extensor muscle of the fingers as they are passing down towards the back of the wrist. 22. The posterior annular ligament of the wrist stretched over the extensor tendons, and binding them down in their proper situations. 23. The abductor muscle of the fore-finger. 24. The insertion of the adductor muscle of the thumb.

Fig. 2. No. 1. The lower part of the arm-bone—os humeri. 2. The posterior fibres of the brachialis anticus muscle brought into view by the removal of the triceps extensor, as seen in fig. 1, No. 3. 3. The anconeus muscle. 4. The short radial extensor muscle; the long radial extensor, and the long supinator, as seen in fig. 1, No. 6, 7, being removed in order to show it more fully. 5. The short supinator muscle (supinator radii brevis). 6. The long abductor of the thumb, or the extensor of its metacarpal bone. 7. The extensor of the first bone (phalanx) of the thumb. 8. The long extensor of the thumb, or the extensor of its second bone (phalanx). 9. The extensor of the index finger. 10. Part of the flexor ulnaris muscle seen arising from the inner condyle of the humerus, and running along the inner border of the arm to reach the fore part of the wrist: its origin from the olecranon process and its aponeurotic attachment along the inner border of the ulna are removed, in order to bring into view No. 11, the deep flexor of the fingers, the fibres of which are seen attached along the inner side of the ulna. 12. A small part of the tendon of the extensor carpi ulnaris muscle, left at its insertion into the fifth metacarpal bone. Close to it is seen the groove which transmits the tendon of the extensor of the little finger. 13. The insertion of the adductor muscle of the thumb. 14. The external origin of the abductor muscle of the fore-finger — between it and the other part which is attached along the metacarpal bone of the fore-finger, is seen an angular interval, which transmits the radial artery as it passes to the palm of the hand.

Plate 20.

Fig. 1.

Fig. 2.

William Fairland lithog.

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Plate 21.

Fig. 1

Fig. 2.

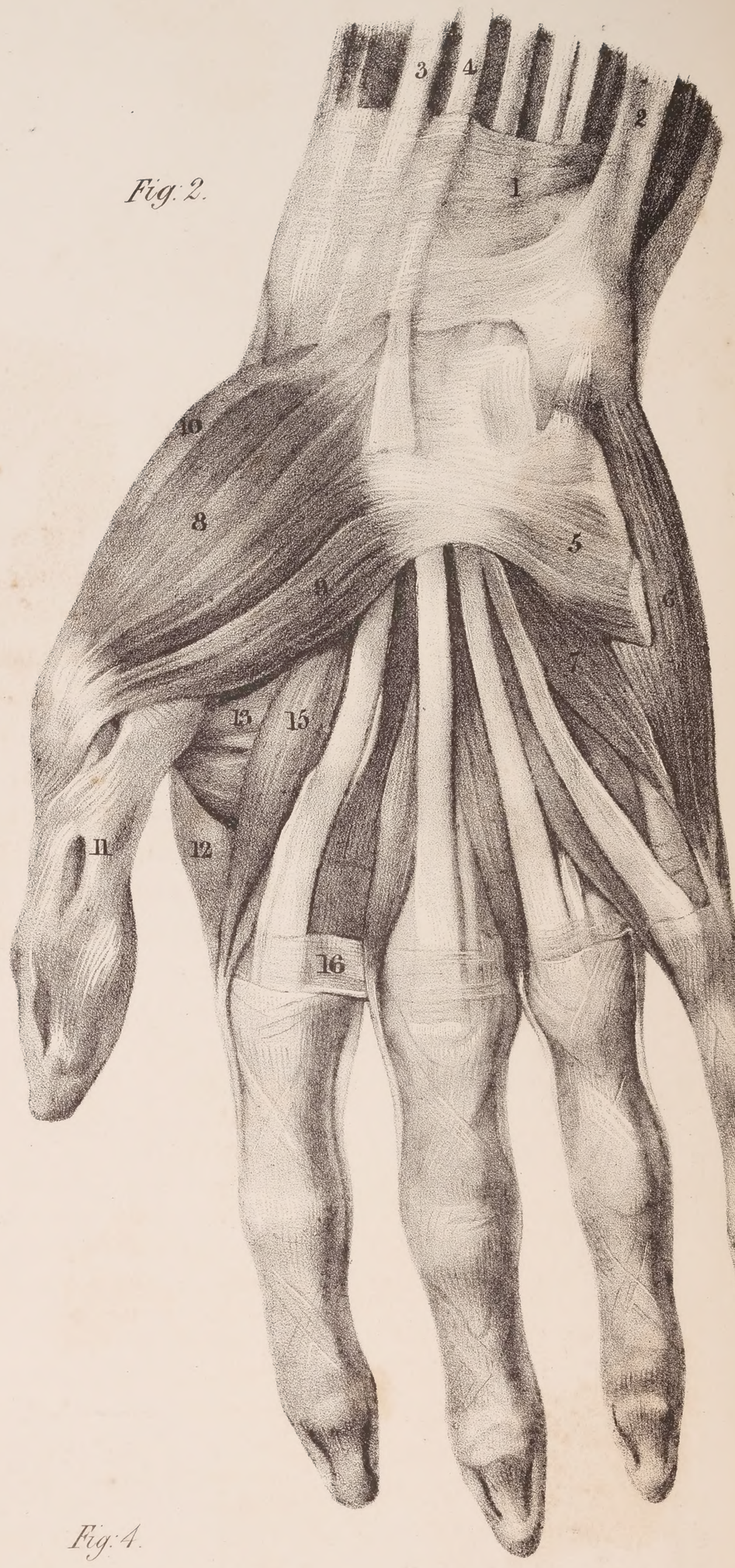


Fig. 3.

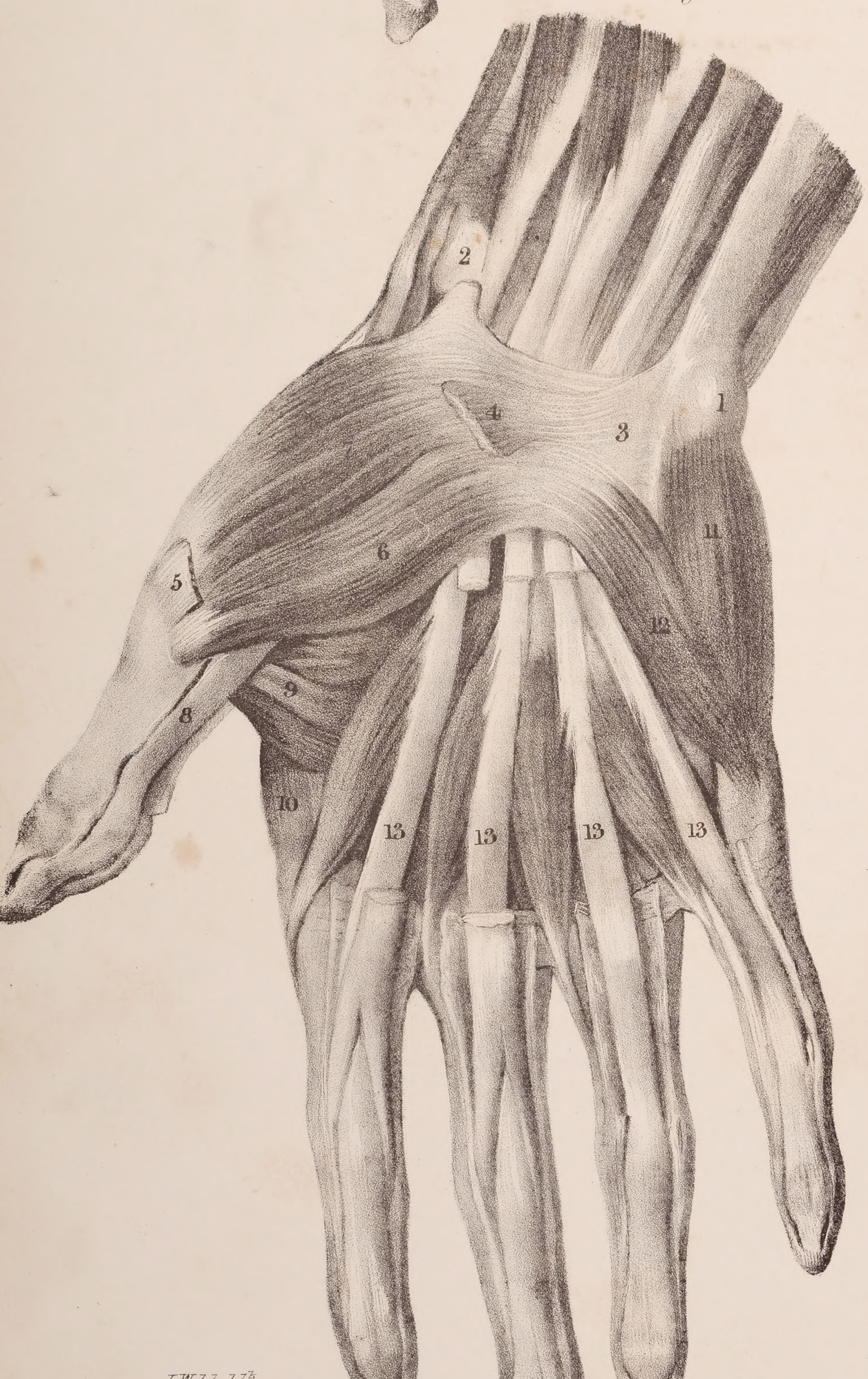
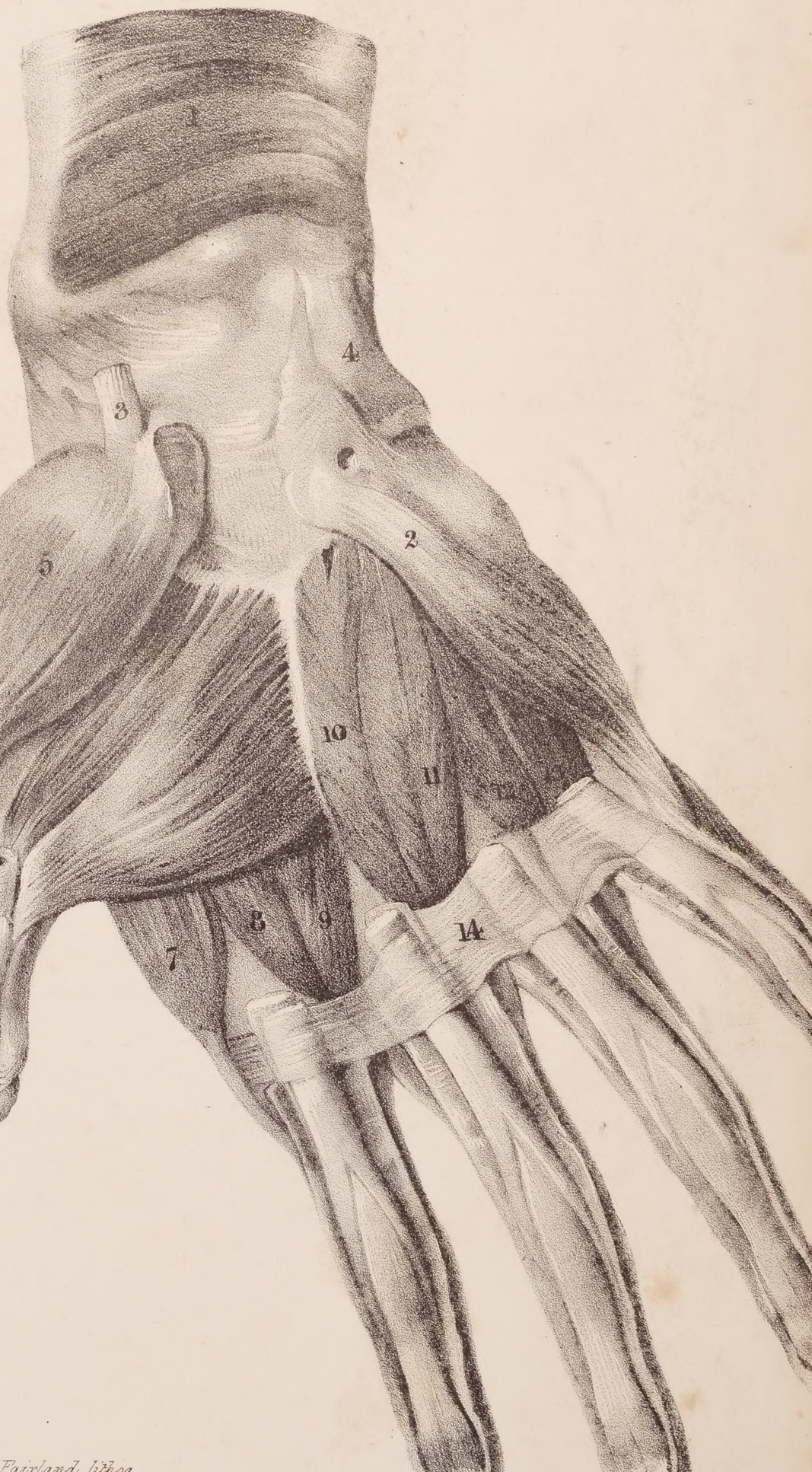


Fig. 4.



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marked projection at the fore part of the wrist, whilst at the back part there is a transverse depression or crease, corresponding with the lower end of the radius. The projection of the carpus renders the flexor tendons tense, and gives rise to the bending of the fingers. If the force of the fall is by any circumstance made to act upon the back of the hand, then the carpal bones will be made to glide from before backwards upon the articular surface of the radius, so as to press against the posterior radio-carpal ligament, and to rupture it. The carpus is thus thrown behind the bones of the fore-arm, constituting the dislocation backwards. In this case the hand, or rather the metacarpus, is drawn forwards or flexed, whilst the fingers are in the extended position. The carpus is very prominent at the back part of the joint, whilst at its palmar aspect there is a transverse depression or crease, corresponding with the lower border of the radius and ulna; the projection of the carpus forces back the extensor tendons, and renders them tense. There is seldom much difficulty in

PLATE XXI.

The drawings in this plate give different views of the hand, the skin and fascia being removed in order to exhibit the muscles more distinctly.

Fig. 1. The back of the hand.

No. 1. Part of the ulna. 2. The lower part of the radius. 3. The posterior annular ligament of the wrist joint. 4. The long abductor muscle of the thumb. 5. The extensor of the first phalanx of the thumb. 6. The tendon of the extensor of the second phalanx of the thumb. 7. The tendons of the common extensor muscle of the fingers (extensor communis digitorum). 8. The tendon of the extensor muscle of the little finger. 9. The tendon of the extensor ulnaris muscle. 10. The tendon of the long radial extensor muscle (extensor carpi radialis longior), at its insertion into the second metacarpal bone. 11. The tendon of the short radial extensor (extensor carpi radialis brevior) at its insertion into the third metacarpal bone. 12. The first dorsal interosseous muscle. The other three muscles of this name are seen in the greater part of their extent in the interstices between the extensor tendons.

Fig. 2. The muscles of the palm of the hand as seen when the palmar fascia is removed.

No. 1. Part of the fascia of the fore-arm. 2. The tendon of the flexor ulnaris muscle. 3. The tendon of the flexor carpi radialis muscle. 4. The palmaris longus. 5. The palmaris brevis. 6. The abductor muscle of the little finger. 7. The short flexor of the little finger (flexor brevis minimi digiti.) 8. The short abductor muscle of the thumb. 9. The short flexor muscle of the thumb. 10. The insertion of the opponens pollicis muscle along the margin of the metacarpal bone of the thumb. 11. The tendinous sheath which binds down the tendon of the long flexor muscle of the thumb. 12. The first dorsal interosseous muscle, called also the abductor of the index finger. 13. Part of the adductor muscle of the thumb. 14. Is omitted. 15. The first lumbricalis muscle. The other muscles of this name are seen passing forwards from the flexor tendons towards the margins of the first bones of the fingers, and becoming tendinous as they are inserted into the edge of the extensor tendon of each finger at its radial border. 16. The commencement of the fibrous sheath which binds down the flexor tendons.

Fig. 3. The second plane of muscles in the palm of the hand.

No. 1. The pisiform bone. 2. The lower extremity of the radius. 3. The anterior annular ligament of the wrist joint. 4. The origin of the short abductor muscle of the thumb. 5. Its insertion, the intervening part being cut away in order to expose the subjacent muscle. 6. The short flexor muscle of the thumb. 7. The opponens of the thumb. 8. The tendon of the long flexor muscle of the thumb passing on to its insertion into the base of its second phalanx. 9. The adductor muscle of the thumb. 10. The abductor of the index finger, or first dorsal interosseous muscle. 11. The abductor muscle of the little finger. 12. The short flexor of the little finger (flexor brevis digiti minimi). 13. The tendons of the deep-seated flexor muscle of the finger (flexor profundus perforans), passing on to their insertions into the last phalanges of the fingers. To expose these, the tendons of the superficial flexor muscles are cut across as they emerge from under the annular ligament of the wrist, and also opposite the first joints of the fingers, and the intervening part taken away. This brings into view the deep flexor tendons in the palm of the hand, and also their accessories, viz. the four lumbricales, which are four tapering fasciculi that arise from the tendons of the flexor muscle, and proceed forwards to be inserted into the borders of the extensor tendons.

Fig. 4. Shows the third plane of muscles in the palm of the hand. The flexor muscles and their tendons, and the superficial muscles of the palm of the hand, are removed in order to bring those which are deep-seated into view.

No. 1. The pronator quadratus muscle. 2. The opponens muscle of the little finger. 3. Part of the tendon of the flexor carpi radialis muscle. 4. The tendon of the flexor carpi ulnaris muscle. 5. The opponens muscle of the thumb. 6. The sheath for the tendon of the flexor longus pollicis muscle, which partly conceals the tendon of the broad triangular muscle (adductor pollicis) converging towards it from the metacarpal bone of the middle finger. 7. Part of the first dorsal interosseous muscle. 8. The first palmar interosseous muscle. 9. The second dorsal interosseous muscle. 10. The third dorsal interosseous muscle. 11. The second palmar interosseous muscle. 12. The fourth dorsal interosseous muscle. 13. The third palmar interosseous muscle. 14. Some of the fibres of the sheaths of the tendons left on in order to retain the tendons in their position; they are drawn a little too strong.

reducing these dislocations, and the mode of proceeding is the same, no matter in what direction the displacement has occurred. The fore-arm is placed in the flexed position, an assistant takes hold of the upper arm firmly with both hands just above the elbow, the surgeon then seizes the patient's hand and makes a steady extension, the assistant keeping a counter-extension, so that the bones of the fore-arm and hand are drawn in opposite directions. As soon as they cease to overlap, the one the other, the muscles will give the displaced part its proper direction, and draw it into its natural position.

In cases of dislocation inwards, the carpus forms a projection towards the inner side of the joint, beneath the inferior extremity of the ulna; the outer edge of the hand is inclined towards the radial border of the fore-arm, as if in the state of forcible abduction. In the dislocation outwards, the carpus becomes prominent beneath the lower extremity of the radius, and the inner border of the hand is drawn towards the ulnar side of the fore-arm, so as to be placed in a state of forced adduction. These displacements being incomplete, are easily reduced; the plan above indicated in the cases of the other two dislocations will suffice for them.

PLATE XX.

The muscles placed at the back part of the fore-arm and hand are here exhibited, the skin and fascia which bind them down having been removed in order to show more distinctly their relative position and points of attachment. They are divided into two sets, one of which is superficial in its entire extent, and overlays the others, so as wholly or in part to conceal them. The superficial set consists of the anconeus, the common extensor of the fingers, the extensor of the little finger, and the inner or ulnar extensor muscle. The deep-seated set consists of the long abductor and the two extensors of the thumb, the extensor of the index finger, and the short supinator muscle.

At the back part of the elbow is seen a small flat triangular muscle, No. 8, fig. 1; No. 3, fig. 2; it is termed anconeus from its position. It commences by a narrow tendon attached to the back part of the outer condyle of the humerus, the fibres of which are prolonged for some way along the outer border of the muscle. From these the fleshy part of the muscle arises, and the fibres of which it is composed will be seen to spread out as they proceed backwards and inwards to be inserted into the outer side of the olecranon process of the ulna, and into the posterior border of the ulna for a little way farther down; the upper fibres of the muscle are very short and nearly horizontal in their direction, but those which succeed them gradually increase in length. It is on the same plane with the triceps extensor muscle, fig. 1, No. 3, of which it often appears to be a continuation, and with which it conspires in its action upon the fore-arm, viz. in extending it so as to bring it into a right line with the humerus.

The common extensor muscle of the fingers, fig. 1, No. 12, extends from the external condyle of the humerus to the extremities of the fingers. It presents a rounded fleshy body, a narrow pointed commencement or origin, and at the middle of the fore-arm a tendinous prolongation, which soon branches out into four flat bands, which, after passing under the posterior annular ligament of the wrist, proceed along the back of the hand to reach the first joints of the fingers, over which they are continued uninterruptedly; whilst passing behind the first bones of the fingers, they receive the insertions of the interossei and lumbricales, which increase their breadth, and give them the appearance of broad aponeuroses covering the back part of the fingers. Near the second joint of each finger the fibres of the tendon appear to separate, so as to leave an elliptic interval between them; this is owing to the fact, that the fibres at the side are comparatively thick and strong, whilst the middle part is thin where it slides behind the joint, and becomes inserted into the extremity of the second bone of the finger; this arrangement of the tendon is calculated to facilitate the bending of the joint, for the knuckle is received in the interstice between the diverging fibres of the tendon. Further on, the parts of the tendon become united again into a flat band, which is inserted into the last bone of the finger: the tendon of the ring finger is observed to be connected with that of the middle one by a transverse slip, which passes from the one to the other; a similar connecting band passes off to the tendon over the little finger. In the present instance, the tendon for the little finger is but a small slip, formed of a few fibres which run along the margin of the tendon of the ring finger, and merely forms part of the oblique slip or connexion already noticed, but which here passes to the proper

extensor of the little finger. This muscle is the direct antagonist of the flexors of the fingers, which are placed at the fore part of the limb, for it extends the bones of which they are composed, so as to bring them into the straight position, and when it has carried the fingers as far back as they will admit of, it can continue its action so as to extend the hand upon the fore-arm.

The proper extensor muscle of the little finger is a long and narrow slip, which lies along the ulnar border of the common extensor muscle, with which its fibres are united in a considerable part of their extent. From the external condyle it stretches down the middle of the fore-arm, and ends in a tendon, No. 13, which after passing under the posterior annular ligament of the wrist is continued over the fifth metacarpal bone, and finally, after becoming blended with the fourth tendon of the common extensor muscle, it is continued over the bones of the little finger, having the same relation and connexions with them which the other extensor tendons have, and like them it is inserted into the base of the last phalanx. The ulnar extensor muscle, No. 14, extends from the outer condyle of the humerus to the upper extremity of the fifth metacarpal bone; some of its upper fibres are attached to the fascia of the fore-arm, and an aponeurotic band between it and the common extensor muscle; and below the anconeus it also has attachments to the posterior surface of the ulna. The tendon into which its fibres run passes through a groove appropriated to it in the annular ligament, previously to its insertion into the fifth metacarpal bone, fig. 2, No. 12. This muscle, when in action, can extend the hand upon the fore-arm, and incline it towards the inner or ulnar side.

The muscles which we have here noticed, partly conceal from view those which lie immediately upon the bones and interosseous ligament, and which form the second plane. These are shown in their entire length in fig. 2, the superficial set being removed. The fibres of the short supinator of the radius, No. 5, represent a flat triangular plane, extended obliquely over the outer border of the radius. It has been already noticed in our comment on Plate XIX. Immediately beneath its lower border is seen the long abductor muscle of the thumb, No. 6; its direction is obliquely downwards and outwards from the ulna, across the interosseous ligament and the radius, to both of which its fibres are attached. In this part of its extent it represents a rounded fleshy fasciculus, which at the lower part of the arm ends in a flat tendon, which after passing through a groove upon the outer border of the radius is fixed to the upper extremity of the metacarpal bone of the thumb; hence it is frequently called the extensor of the metacarpal bone. At its lower border, and partly concealed by it, is placed the extensor of the first bone of the thumb, No. 7, which is shorter and smaller than the preceding; its fibres are attached to the interosseous ligament and radius, and take the same oblique direction from above, downwards and outwards, to end in a narrow tendon which runs through the same groove in the radius that transmits the tendon of the extensor of the metacarpal bone, and is thence continued onwards to be inserted into the base of the first phalanx of the thumb. The extensor of the second bone of the thumb, No. 8, also runs an oblique course, but its tendon is separated by an interval from the preceding, and slides in a groove appropriated to itself at the back part of the radius. Its fibres arise from the middle third of the ulna and from the interosseous ligament, and the tendon in which they terminate, after passing through the groove in the radius just noticed, slides over the insertion of the two radial extensors, (fig. 1, 19, 20,) and is prolonged upon the dorsal surface of the thumb to the base of its last phalanx, into which it is inserted. Still lower down, and on the same plane, lies the extensor of the index finger, No. 9; its fibres are attached to the posterior surface of the ulna and the interosseous ligament. The tendon in which its fibres terminate will be found in the groove which transmits the common extensor muscle, and as it passes along the back of the hand it is in close contact with the band given by the common extensor to the index finger, with which it becomes identified.

The tendons of the extensor muscles, whilst running along the back of the hand, overlay and partly conceal from view some small muscles, which are deeply seated, inasmuch as they lie in the intervals between the metacarpal bones, from which circumstance they are termed the interosseous muscles. In order to bring them fully into view, the extensor muscles, with their tendons, are cut across over the first joints of the fingers, fig. 2, and removed, and the tendon of the indicator muscle is drawn slightly out of its place. There are four interosseous spaces, each of which at the dorsal aspect of the hand is occupied by a muscle. At the palmar aspect there are three, the tendons of which are here slightly seen as they are prolonged from the palm in the second, third, and fourth interosseous spaces, to be inserted into the margins of the extensor tendons. The first dorsal interosseous muscle is the largest of the set, and occupies the interval between the metacarpal bone of the thumb and that of the fore-finger; its fibres arise from the contiguous margins of these two

bones, and at first appear as two bundles separated by an angular interval, but as they proceed forwards, each approaching the other, they unite and form a flat narrow muscle, and this ends in a tendon which is inserted into the base of the first bone of the fore-finger, and is also connected with the outer margin of the tendon over that finger; from its line of direction it is obvious that this muscle can draw the fore-finger away from the rest, on which account it is called the abductor of the index finger. The second and third dorsal interosseous muscles arise from the contiguous margins of the metacarpal bones, between which they lie; they also consist of oblique fibres, which converge towards a middle line; each ends in a narrow tendon, which is inserted into the margin of the extensor tendon, lying over the middle finger. These, when in action, can incline the finger laterally; the one drawing it inwards, the other outwards. The fourth dorsal interosseous muscle, similar in structure and mode of origin to the preceding, is inserted along the inner or ulnar side of the extensor tendon of the ring finger.

PLATE XXI.

The drawings here given exhibit different views of the hand placed in the position in which it is usually examined by the anatomist. The skin and fascia are removed in order that the form, the lines of direction, and the points of attachment of the muscles may be distinctly seen. What a number of objects are here grouped together in a small space! the bones which form the substratum that gives support to the rest vary much in form and size, so do the muscles which move them, and their number is proportioned to the variety of motions which the hand can perform. In every part of the body, evidence of design and contrivance may be traced; in none is it more clearly demonstrable than in the hand, and the demonstration may be rendered more complete were we to extend our observation to the whole limb of which it forms a part. Observation shows us how well adapted it is for its different purposes and uses, and how infinitely various these are. Let us contrast it with the lower extremity: placing them side by side, we see that the parts of which they are composed, I mean the anatomical elements of which they are made up, are analogous in every particular. Just take the basis, or substratum, which gives support to the other structures,—the osseous part: laying them thus together, (fig. 1, 2,) we see that they consist of the same number of pieces, viz. the femur (*a*), and humerus (*a**), the two bones (*c, d,*) of the leg, and those of the fore-arm (*c* d**), the different pieces in the tarsus (*e*) and carpus (*e**), those of the meta-tarsal row (*f*), and in the meta-carpus (*f**), and lastly those of the toes (*g*), and of the fingers (*g**). The femur, strongly made, is, at its upper part, lodged in a deep cup-shaped socket, by means of which the whole weight of the body is thrown on the limb; at its lower end it is expanded so as to increase the surface by which it rests on the leg. The bones of the leg are also firm in themselves, and closely bound together so as to admit of no motion upon one another; they rest securely on the foot, the upper bone of which is lodged in a socket, which they form. The humerus,

PLATE XXII.

This drawing exhibits the first layer or plane of muscles placed along the back and side of the body; the skin and the cellular tissue being removed in order to show the direction of the fibres in each muscle, and their points of attachment.

No. 1. The protuberance of the occipital bone. 2. The mastoid process of the temporal bone. 3. The acromion process of the right scapula. 4, 4. The spinous processes of the two scapulæ. 5, 5. The base of each scapula. 6, 6. The margins of the iliac bones. 7. The sterno-cleido-mastoid muscle. 8. Part of the splenius as seen between the margin of the preceding and of the trapezius. 9. Part of the levator scapulæ. 10, 10. The trapezius muscle of each side; and as it is of very considerable extent, forming a flat angular plane which extends from the occiput to the spinous process of the last dorsal vertebra; the numbers 10, 10, are repeated in the lower part of it. 11, 11. The latissimus dorsi muscle of each side, which is also of considerable size. 12. The external oblique muscle of the abdomen. 13. Part of the border of the great serratus muscle, presenting angular points interposed between the fibres of the external oblique muscle. 14. A part of the lower border of the great pectoral muscle where it forms the anterior fold of the axilla. 15. The teres major muscle. 16. The teres minor muscle. 17. The infra-spinatus muscle. 18. A small part of the greater rhomboid muscle. 19. Some of the fibres of the longissimus dorsi muscle which are deeply seated, and exposed only when the scapula is drawn forwards, as here exhibited. 20. The deltoid muscle. 21. Part of the upper extremity of the brachialis anticus muscle where it arises below the insertion of the deltoid. 22. The long head of the triceps extensor muscle of the arm. 23. Its external or middle head.

Plate 22.

del.ᵇ

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William Fairland lith.

Printed by Graf & Soret.

Plate 23.

J. Walsh del.

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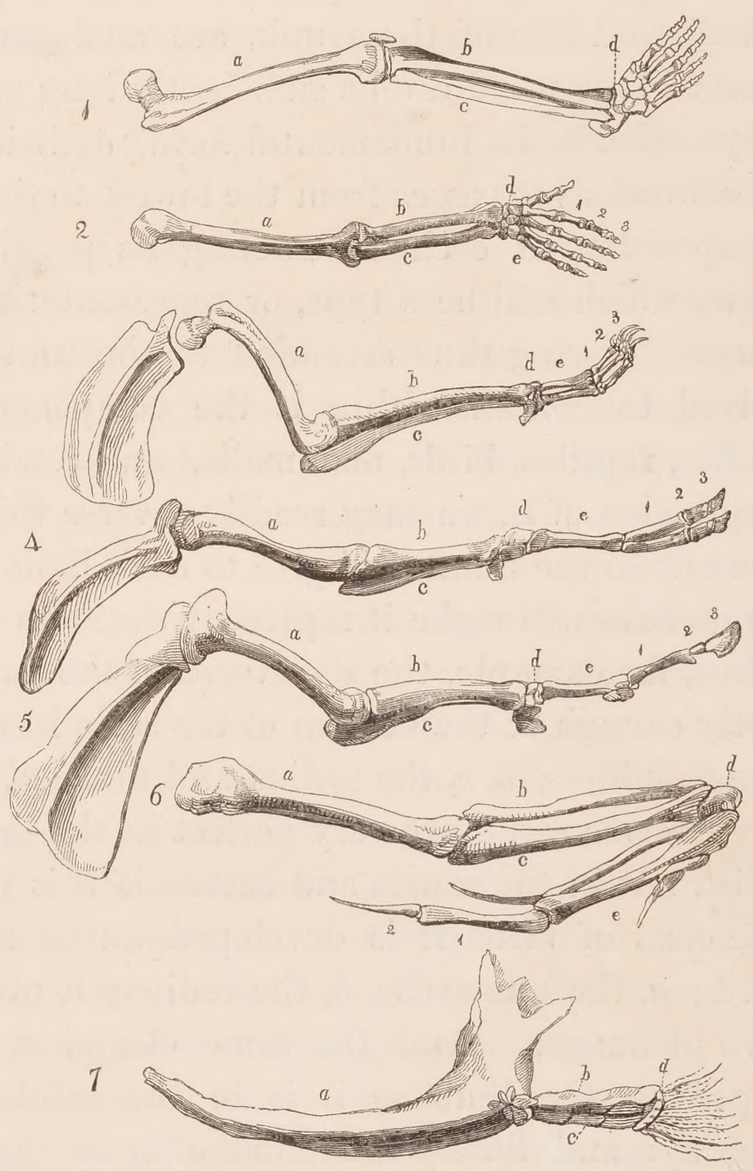
William Fairland lith.

on the contrary, is barely in contact with a superficial depression on which it moves, and so admits, at the shoulder, the utmost variety and latitude of movement; the bones of the fore-arm, too, are calculated for flexibility and motion, one rolling on the other, and both fitted with a perfect apparatus of muscles or moving powers, which, with the utmost ease and precision, turn the wrist, and guide the hand to any object to which it is to be applied. The bones, then, in arrangement and general plan, are similar, yet, by slight modifications, are fitted for totally different purposes.

The hand and the foot (2, 1,) agree in the elements of which they are composed, and in the number of them; but they are developed so differently in each, that they form totally distinct members, and serve for widely different purposes. The solid and the moveable parts in each are strongly contrasted; the pieces which compose the solid part of the foot (fig. 1) are strong and large, those of the hand (2), are comparatively diminutive, but the fingers, or flexible part, are largely developed, as compared with the toes. It is commonly said that this arises merely because the toes are less necessary for support and progression than the rest of the foot, whilst the fingers are more necessary for prehension and adjustment than the rest of the hand; it would be more correct to say that it is the result of a general law which pervades the whole animal kingdom, a law which establishes what may be termed a principle of compensation, by virtue of which, if any given part is increased above par, its increase is effected at the expense of some other; or, as it has been technically expressed, if the "formative effort" be strongly directed to one part, it will be less so to some neighbouring one. The arch of the foot is the more important part in reference to its general purpose of sustaining the body, the toes being obviously less so as a means of support or progression. It is just the reverse in the hand: the fingers, or flexible part, being the more important one, in reference to the various purposes which the hand has to perform, and therefore they are proportionally evolved or developed.

Again, when we direct our attention to a single part of the hand, viz. the thumb, and contrast it with the corresponding part of the foot, we see how a new instrument is produced by a mere modification of its constituents. The bones, the muscles, vessels, and nerves of the thumb, and of the great toe, are respectively analogous, yet how different are the purposes which they are intended to fulfil? The first bone of the toe is thick and strong, it ranges with those of the other toes, and admits of little more motion than they do, as it is one of the chief points on which the weight of the body is thrown in its different movements. The first bone of the thumb admits of every variety of motion; it does not range with those of the fingers, from which arises its most striking peculiarity, that of being brought into opposition with the rest. In its various uses it is not merely a part of the hand,—it is rather a new member, or a supplemental hand. Thus we see what a variety of results are obtained from a few materials, and how, by a modification in the form, proportion, and arrangement of the same constituents, new instruments are produced,—new powers created.



But let us not confine our attention to the structure of the human frame, let us glance at that of other ani-

PLATE XXIII.

This drawing is intended to exhibit the external oblique muscle of the abdomen, and its different points of attachment; the skin and the fascia are removed, so as to show its relations at its origin to the pectoral, serratus, and latissimus muscles.

No. 1. The sternum. 2. Linea alba. 3. Umbilicus. 4. The symphysis of the pubes. 5. The crest of the ilium. 6, 6. The lower part of the pectoral muscles. 7. Part of the latissimus dorsi. 8. Part of the great serratus muscle. 9. The external oblique muscle of the abdomen (m. obliquus externus abdominus).

mals, still for illustration, confining our attention to the instance already selected, viz. the upper or anterior extremity: take that in one of the lower animals, say the cat. Ordinarily it sustains the body, therefore, is an instrument of support; its parts move on one another, and, when acted on by the muscles, it becomes an instrument of progression; it is terminated by moveable phalanges, which may be flexed or extended, and so it becomes a means of prehension; finally, the last phalanges, which are usually turned back, may be pushed forward to a line with the rest, protruding the sharp nails with which they are armed, and so it becomes an instrument of attack or defence. In the monkey this limb serves for support and progression, but chiefly for the prehension of objects; it is not well calculated for defence or attack. In the dog and in hoofed animals it serves for support and progress; in birds for progression only; whilst in fishes it merely assists in progression, as that is effected chiefly by the movement of the hinder part of the body. Now, in the anterior limb in all these animals, we find the same bones, muscles, nerves, vessels, &c.; and all the variety of purpose which they serve is attained by modification in the size, form, and mode of connexion of these components. We often speak of the simplicity of Nature's works, here that simplicity is fully exemplified. These limbs consist of the same parts,—the materials are identical; yet, as we have seen, they execute different functions, and so may be considered as different organs, which is sufficiently indicated by the different names by which they are popularly known. And all this is effected by one portion being largely developed, a contiguous one being less so,—some being evolved to a maximum, whilst others are left rudimentary, as if Nature were sparing of her materials, yet profuse in the results she would elaborate out of them: and this is what we really mean when we speak of the simplicity of Nature's works, as contrasted with the grandeur and comprehensiveness of her designs.

When we have inspected attentively the leading divisions of the animal kingdom, and examined the structure of its different orders, say from the fishes up to the mammalia, we see that, though variously modified, the proximate or anatomical constituents of the members (as in the instances cited), and also of the trunk, are analogous. Now, whilst we pass from link to link in this great chain, if the mind dwells sufficiently long on each of the natural families which it connects to retain an impression of its fundamental form, omitting the minor traits which give to each its individuality; if, in a word, as it passes from the lowest to the highest, it retains that which is essential in the form and composition of each, abstracting its peculiarities, it will gradually ascend to the contemplation of a form, which will be a type, or representative of all, divested of the peculiarities which mark each of them. Having thus ascended to the contemplation of a type, or abstract form, which may be conceived to contain within it the components, or anatomical elements, of each of the great classes (fishes, reptiles, birds, mammalia,) and retaining it for a while before the mind's eye, so as to fix the impression of it, we may readily reverse this process, and proceed to evolve the model which is thus present to the mind, and give to each limb, as well as to the body, such a degree of expansion or development as will make it represent the form which it presents in a fish, a reptile, a bird, or a quadruped. Thus, for example, the structures of the anterior extremity whilst in their rudimental state, are found aptly enough at the bottom of the scale in form of the fishes' fin. (In fig. 7, *a* represents the bones of the shoulder; *b*, *c*, the radius and ulna; *d*, the fin-rays, being so many digital processes). We find the osseous structure very perfect in the limbs of the amphibia. In the ophidian reptiles it does not exist, but in the sauria and batrachia it is variously modified, to suit the habits of these animals. In the class of birds it is developed considerably to form the wing; fig. 6 shows part of the wing of a bird; *a*, the humerus; *b*, the radius; *c*, ulna; *d*, carpus; *e*, metacarpus; 1, 2, the great finger — its two phalanges. And the same elements, by receiving their appropriate adjustment, are made to represent the limb as it is in the solidungula (fig. 5); in the bisulca (fig. 4); in the feline tribe (fig. 3); and finally the hand of man (fig. 2). Having thus sketched a part in each, we may, by a similar process, complete the figure by following it out through the posterior extremity, and then the body, spine, and head; the parts of the skull being analogous to vertebræ. It is in this way only that we can form any adequate conception of the plan or groundwork from which the different varieties of animal forms are deduced. For, when we look over a menagerie, or a great assemblage of animals, our first impression is that of variety and discrepancy; but, on a closer inspection, we find that some are nearly allied, and form groups or families, marked by certain peculiarities and natural affinities. But we could never have supposed that any such uniformity of plan ran through them all, unless we had examined their intimate structure and composition. Then it is that we readily see the analogies by which they are associated, and trace the unity of design which runs through the whole scheme.

The muscles of the palm of the hand are necessarily numerous, owing to the variety of the

movements which the hand and fingers are required to perform. Were we to arrange them according to their actions and uses, we should have a group consisting of flexors, another of adductors, a third of abductors; it is, however, found much more convenient to arrange them according to the positions which they occupy. Viewed in this way, they admit of being divided into three sets, those of the thumb, of the little finger, and those which occupy the intervening space in the middle of the palm. The palmar muscles of the thumb form that fleshy mass which, in popular language, is called the ball of the thumb; they are four in number, viz. the abductor, the opponens, the short flexor, and the adductor. The abductor is a flat thin muscle, fig. 2, No. 8; it is placed immediately under the skin, extended obliquely from the anterior annular ligament of the wrist and the scaphoid bone to the outer edge of the first phalanx of the thumb at its base; it is broader at its origin than at its insertion, as it gradually narrows to a short tendon near the latter point. It is covered merely by the skin and a thin membrane, derived from the palmar fascia.

The opponens muscle of the thumb, fig. 3, No. 7, is thicker than the preceding, under which it lies, so that in order to bring it into view, the abductor must be detached at its origin and reflected downwards, or the middle part may be removed and the attachments allowed to remain, as in the drawing before us, fig. 3, Nos. 4, 5. The opponens will then appear a small triangular muscle, extending from the outer part of the annular ligament and the surface of the trapezium bone to the metacarpal bone of the thumb, into the outer border of which its fibres are inserted along its entire length. It is aponeuretic at its extremities, and fleshy along its middle.

The short flexor muscle, fig. 3, No. 6, arises from the lower border of the annular ligament, and from the reflected part of it which binds down the tendon of the flexor carpi radialis; some of its fibres are also attached to the trapezium bone. The fibres of the muscle proceed outwards and forwards, gradually narrowing to a short tendon, which, after being attached to the external sesamoid bone, becomes fixed to the base of the first phalanx of the thumb. The contiguous fibres which arise from the os magnum, and are inserted into the internal sesamoid bone, are usually considered a part of the short flexor; we here join them to the adductor.

The adductor muscle of the thumb, fig. 4, No. 6, is broad and triangular in its form, representing a flat plane of fleshy fibres, placed deeply under cover of the preceding muscles, a part only of the anterior fibres projecting before them, fig. 3, No. 9. It arises from the anterior border of the third metacarpal bone, from the os magnum and the trapezoid bone, also by a few fibres from the trapezium. The anterior fibres pass transversely outwards, those higher up become more and more oblique, so that they converge, and become narrow towards their insertion, which is effected by means of a narrow tendon, which, after being connected with the internal sesamoid bone, is fixed to the inner side of the first phalanx of the thumb; the outer and upper part of the muscle is usually considered as forming a part of the flexor brevis.

Actions.—On taking a general view of the muscles of the thumb, which are eight in number, we perceive that, though all of them are attached to the three bones, they come from three different situations, and necessarily differ much from one another in form and length, as well as in the direction of their fibres. Three of them lie along the back part of the fore-arm and hand, Plate XX. fig. 2, Nos. 6, 7, 8; one will be found at the front of the fore-arm, part of which is seen in plate XXI. fig. 3, No. 8; the remainder being the group of short muscles, which are shown here in Plate XXI. figs. 2, 3, 4; the actions and powers of each of these muscles will readily be understood by considering their points of attachment, and the direction of their fibres. It should be recollected that there are three pieces of bone in the thumb, each of which is straightened or bent by appropriate muscles; that all are joined together so as to admit of four separate movements, for they may be drawn backwards, forwards, inwards, outwards, which movements are technically called extension, flexion, adduction, abduction. Now there are three extensor muscles, one for each bone, viz. the extensor of the metacarpal bone, that of the first and the second phalanx. These are the muscles above referred to as being placed at the back of the limb; their antagonists in action, the flexors, are also three in number, and lie at the palmar aspect of the hand. The opponens of the thumb may be considered a flexor of the metacarpal bone, the short flexor bends the first phalanx, and the long flexor the second. There remain the abductor and adductor, which are also opposed to one another in situation as well as in action; one being superficial and external, fig. 2, No. 8; whilst the other is deep-seated and internal, fig. 4, No. 6. The former is evidently fitted to draw the thumb away from the other fingers, in which it is powerfully assisted by the extensor of the metacarpal bone, which is frequently called from this circumstance the long abductor; the latter, as its name implies, and as is obvious from the

number and direction of its fibres, draws the thumb towards the other fingers. If these moving powers be made to act successively upon the osseous pieces under their control, they will make the thumb move round as if in a circle, or perform what is technically termed circumduction ; in which movement it describes a cone, whose summit is at the carpal articulation, whilst its base is represented by the line which its distal extremity traverses.

The four tapering fleshy fasciculi which are seen in fig. 2 and fig. 3 attached to the deep-seated flexor tendons, are called lumbricales, from some resemblance in their form to an earth-worm ; they may be considered as appendages to the tendons of the deep muscle just named. The first lumbricalis arises from the outer border of the tendon, which goes to the fore-finger ; the second from that of the middle finger ; the third from the contiguous margins of the tendons going to the middle and ring-fingers ; and the fourth from the latter and that of the little finger. As they proceed forwards they become round and tapering, and each ends in a tendinous process, which is fixed to the outer edge of the extensor tendons, lying over the fingers with which they correspond ; they appear to assist in flexing the fingers by acting on their first joint.

Muscles of the Little Finger.—The fleshy mass placed along the inner border of the hand consists of four muscles, three of which act on the little finger, the other being merely cutaneous. The cutaneous muscle is that by which we are enabled to constrict and pucker the skin upon the inner border of the palm of the hand. It consists of a flat and very thin plane of fleshy fibres, which run obliquely inwards, from the anterior surface of the annular ligament and of the palmar fascia, and become fixed into the skin, along the inner border of the palm of the hand, for about an inch in length ; it is usually called palmaris brevis, fig. 2, No. 5. The abductor muscle of the little finger, fig. 2, No. 6, lies along the inner edge of the hand ; it is long and somewhat compressed, broader at its middle than at its extremities ; it arises from the pisiforme bone and fron the tendinous fibres, which connect it with the annular ligament : its muscular fibres as they proceed forwards gradually end in a narrow tendon, which becomes attached to the inner border of the base of the first bone of the little finger, where its fibres are connected with those of the flexor brevis.

The short flexor of the little finger, fig. 2, No, 7, fig. 3, No. 12, varies much in form and size, and sometimes does not exist. It arises by short tendinous fibres from the annular ligament at its anterior border, and from the hook-shaped bone at the wrist, from whence it proceeds obliquely forwards to be inserted into the base of the first phalanx of the little finger. The opponens of the little finger, fig. 4, No. 2, is concealed by the preceding muscles, which must be removed in order to bring it into view ; it may be considered an adductor of the fifth metacarpal bone, as the opponens of the thumb is of the first, fig. 4, No. 5. It arises from the hook-shaped bone and from the annular ligament of the wrist, and is inserted into the inner border of the fifth metacarpal bone, its fibres gradually spreading out as they proceed to their points of attachment. The names of these muscles sufficiently indicate their actions.

The Interosseous Muscles.—These are divided into two groups, one of which is seen at the dorsal aspect of the hand, between the metacarpal bones ; from which circumstance they are called the dorsal interossei. They are four in number, and are shown in Plate XX. figs. 1, 2; also in Plate XXI. fig. 1. We have already described them in pp. 43, 44.

When the flexor tendons are removed, as in fig. 4, Plate XXI. the deep-seated muscles of the palm of the hand are brought into view ; all the interossei are seen, for the dorsal group dip downwards and become perceptible in the palm. Nos. 7, 9, 10, 12, mark the dorsal group, whilst Nos. 8, 11, 13, indicate the palmar set. The first palmar interosseous muscle, No. 8, is a thin, compressed, fleshy fasciculus, which rests upon the second metacarpal bone, at its inner side ; it ends in

PLATE XXIV.

Fig. 1. Shows the two planes of intercostal muscles.

No. 1. The dorsal vertebræ. 2, 2. The heads of the ribs attached to them. 3, 3, 3. Ribs. 4. The external plane of intercostal muscle, the direction of its fibres being downwards and forwards. 5, 5. The internal plane of intercostal muscles, the fibres being directed downwards and backwards.

Fig. 2. Shows the internal oblique muscle, the direction of its fibres, and its different points of attachment.

No. 1. The lower ribs. 2. The crest of the ilium. 3. The umbilicus. 4. The linea alba. 5. The fleshy fibres of the internal oblique muscle (m. obliquus ascendens abdominis). 6. Its aponeurosis, extending forwards to reach the linea alba. 7. Part of the latissimus dorsi muscle.

Plate 24.

Fig. 1.

Fig. 2.

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William Fairbairn sculp.

Printed by Graf

Plate 25.

J. Walsh del.ª

William Fairland lith

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London, John Taylor, Upper Gower St.

a narrow tendon, which is fixed into the expansion of the extensor tendon over the fore-finger, at the inner side of the base of its first phalanx. The second palmar interosseous muscle, No. 11, lies along the fourth metacarpal bone at its outer border; it is inserted into the outer border of the extensor tendon, covering the ring-finger. The third, No. 13, lies upon the outer side of the fifth metacarpal bone, and is inserted into the corresponding border of the extensor tendon. The tendons of these muscles are also connected with the first phalanges of the fingers to which they belong. From the direction of the fibres of these fleshy fasciculi, it is obvious that they are enabled to incline the fingers to which they belong inwards or outwards, and, by a simultaneous movement, to separate them one from each other, or spread them out, and then draw them together again.

PLATE XXII.

The two broad muscles of the back are here seen in their entire extent, Nos. 10 and 11; the other references belong to muscles which we have previously noticed, or which will be given in subsequent drawings. The muscles of the back are generally considered as being arranged in layers just as we find them in prosecuting their dissection. The two which we here mark off form the first layer, for they lie immediately under the skin, one extending from the occiput to the lower part of the back, the other from the middle of the back downwards to the pelvis and lower part of the spine. The trapezius muscle, fig. 10, extends along the posterior part of the neck as well as of the back and shoulder. If the muscle of one side be taken by itself, its form is triangular; but both together represent a quadrilateral figure, whose four sides are not equal, and none of its sides parallel, from which circumstance its name is taken. The fibres of the trapezius muscle are attached to the external protuberance of the occipital bone, and for a short way to the oblique ridge leading outwards from it. Plate XXII. No. 1. In the neck the fibres of both muscles are united in the middle line, and are also connected with a tendinous band, which is attached to the spinous processes of the vertebra; lower down they take origin from the spinous process of the last cervical vertebra, and from all those of the dorsal region, as well as from the ligaments which connect them. From these different points the fibres proceed towards the spine of the scapula, the top of the shoulder, and the external part of the clavicle, into which they become inserted. The fibres which come from the last cervical and the upper dorsal vertebra pass horizontally outwards; those above them descend, while those below them ascend. The line of insertion into the upper border of the spine of the capsula and of the acromion process are marked 4 and 3. This muscle is fleshy in the greater part of its extent, but its points of attachment are tendinous.

The broad muscle of the back, latissimus dorsi, No. 11, is of very considerable extent, as its name implies. It extends from the lower half of the spine and from the back part of the pelvis obliquely outwards over the loins and the side, and across the axilla to the arm. Its lower and back part con-

PLATE XXV.

This drawing represents the transversalis muscle of the abdomen, the external oblique muscle and the internal oblique having been removed in order to show it more fully; the greater part of the rectus muscle of the right side is also taken away with the same view, and also to show that at the lower part of the last-named muscle the aponeurosis of the transversalis muscle passes in front of it, though higher up it passes behind it.

No. 1. The sternum. 2. The cartilages of the ribs. 3. The crest of the ilium. 4. The pointed processes by which the great serratus muscle arises. 5. A part of the external oblique muscle of the abdomen left upon the ribs, where its fibres will be seen insinuating themselves between those of the serratus. 6. Part of the latissimus dorsi muscle, its anterior edge being everted in order to expose the aponeurosis, which passes backwards from the transversalis muscle deeply into the lumbar region, where it becomes attached to the roots and points of the transverse processes of the vertebræ, after having formed a sheath for the quadratus muscle. 7. The transversalis muscle of the abdomen (m. transversus abdominis, m. lombo-abdominal). 8. Its aponeurosis, where it lies behind the rectus muscle. 9. The lower part of its aponeurosis, where it passes in front of the muscle. 10. A transverse section of the rectus muscle of the right side, the upper two-thirds of it being removed. 11. The rectus muscle of the left side. 12. The lower part of the transversalis muscle, where it passes over the spermatic cord. 13. The umbilicus, or navel. 14, 14. The linea alba.

sists of a broad aponeurosis; the rest forms a flat plane of muscular fibres, which gradually become aggregated together so as to form a thick narrow fasciculus as it proceeds towards its insertion. Its commencing fibres are attached to the spinous processes of the six lower dorsal vertebræ, where they are covered by the trapezius; lower down they are attached to the spinous processes of the lumbar region and the sacrum, and to the supra-spinous ligaments; they are also seen to be attached to the crest of the ilium, No. 6. The broad aponeurosis which thus commences gives origin to the fleshy fibres which form the rest of the muscle; some of these, however, have a separate origin, for at its lower and outer border three or four points are seen, which, starting from the lower ribs, proceed obliquely upwards and forwards, and become blended with the rest of the muscle. The upper border of the latissimus muscle slides over the inferior angle of the scapula and the origin of the teres major (15); the narrow fasciculus into which its fibres are collected forms the posterior fold of the axilla, where it turns upon the teres major so as to get in front of it, and then ends in a flat tendon about an inch and a half in breadth, which is inserted into the posterior border of the bicipital groove in the humerus.

Actions.—The trapezius muscle can be made to act on the head, on the shoulder, or on the spine. Thus, if the shoulders be fixed, the upper fibres are enabled to draw the head either backwards or to their own side; if the spine and head be fixed, the shoulder can be drawn backwards, particularly if another muscle (the rhomboid), which lies under it, and part of which is here seen, No. 18, be made to act at the same time. It raises the shoulder; but the scapula seldom moves directly backwards, or upwards, or downwards; these changes in its position are generally found accompanied by a movement of rotation, by which it is made to turn as if on a pivot driven through its centre.

When the latissimus muscle acts on the shaft of the humerus, it can obviously draw it downwards and bring the limb closely to the side; but at the same time it gives it a rotatory motion on its axis. If the shoulder and arm be fixed, the latissimus muscle can be made to assist in inspiration, by elevating the lower ribs; it also assists in drawing up the body in the effort of climbing. On the same principle this muscle and the pectoralis major enable a person to avail himself of the assistance of crutches; the top of the crutch serves as a fulcrum which supports the arm, and as the margins of these muscles rest upon it, they are enabled to draw the body upwards towards it as to a fixed point. When the shoulder and arm are fixed, the trapezius and latissimus muscles are enabled to act upon the spine, particularly in restoring the body to the erect position when it inclines to either side. On looking at the plate, it will be at once perceived that the fibres of the trapezius may be made to act from the shoulder upon the spine in a considerable part of its length, provided the shoulder is rendered fixed. The latissimus muscle can act in the same way upon the lower half of the spine if the arm be placed in the same position as is here represented, viz. thrown out from the side and steadily fixed by the action of its muscles; this preparatory movement would enable both muscles together to act upon the spine. Suppose an individual when walking upon a narrow board finds himself inclining to the left side so much as to be in danger of losing his balance, he instinctively throws out his right arm in order to give these two muscles fixed points at their outer ends, which at once enables them to draw upon the spine and restore it to the erect posture. In the position here supposed, the spine for the moment forms a curve, whose concavity is to the left side and convexity to the right, by which means the upper part of the trapezius and the lower part of the latissimus of the right are put into a state of tension, inasmuch as their points of attachment are farther separated than when in the condition of repose, whilst the middle fibres are somewhat relaxed; under such circumstances the fibres of the muscles which are attached to the upper and lower ends of the spine will be made by an effort of the will to pull upon them, and draw them to their own side; at the same moment those portions of the corresponding muscles of the opposite sides which are attached to the middle part of the spine (which in the case here supposed are rendered tense), are enabled not only to fix that part of the column so as to enable the muscles of the opposite side to act more steadily upon its extreme points, but by a continuance of their effort they can even draw that part towards their own side; by this combination of efforts it is that the spine, like a flexible column, is subjected to the influence of forces which act upon it from opposite sides, and restored to its equilibrium by a nice adjustment of power directed by a voluntary and instinctive impulse. To maintain himself erect the rope-dancer uses a pole, which he holds with both hands in the horizontal position, and which he inclines now to one side now to the other; the pole is his only security, for by grasping it firmly he can render his arms fixed, and thereby give to the muscles points from which they may act upon the spine, so as to straighten the curves or lateral flexures into which it is necessarily thrown during his various evolutions.

PLATE XXIII.

A side view of the body is here given in order to show the first stratum of muscular fibres which covers the abdomen. Its points of attachment to the ribs are disposed in a peculiar way with regard to the great pectoral muscle, the serratus, and the latissimus, which are here indicated; its insertion into the haunch-bone is also obvious, moreover, in the interval between the lower margin of the chest and the most projecting part of the haunch-bone; the muscular fibres end in a broad flat membrane or aponeurosis, which is prolonged inwards over the fore part of the abdomen so as to become blended with a similar production from the muscle of the opposite side along the whole space from the lower extremity of the breast-bone to the pubes. The line of junction here indicated is termed the white line (linea alba, No. 2); it is distinctly shown in plate XXV. No. 14, in which the aponeuroses are cut away at each side, and a mere narrow cord left, which is formed by the junction of their fibres; it may be considered as the common point of junction of the three pairs of muscles which form the parietes of the abdomen; it is interposed between the two recti muscles, which in plate XXIII. are seen somewhat to project in slight relief from under the aponeurosis which covers them; but in plate XXV. the rectus of the left side is seen distinctly in its entire length, the aponeurosis being removed in order to expose it. The white line (linea alba) is broader at its upper than at its lower extremity, for there a wider interval exists between the recti muscles. At its middle the umbilicus or navel exists, which may be considered a cicatrix remaining after the closure of the aperture which gives passage to the umbilical cord during fœtal life.

The muscles which cover the abdomen, and form the walls of that cavity from the ribs and sternum to the pelvis, at the front, at the sides, and backwards even to the lumbar part of the spine, are three broad flat planes composed of fleshy and tendinous fibres, placed one over the other, the fibres of each running in a different direction from the others; from which circumstance the external one, seen in plate XXIII, is called the oblique muscle, with descending fibres: the next, seen in plate XXIV, is the oblique muscle, with ascending fibres: and the third, plate XXV. No 7, is the transverse muscle. In front there is a pair which extends from the lower part of the chest directly down to the pubes, and is thence called the recti muscles, plate XXV. No. 11. We frequently find an accessory pair in the form of two small triangular muscles that rest upon the lower part of the recti, extending from the pubes about two inches, or two and a half inches upwards.

The external oblique muscle, as seen in plate XXIII. No. 9, is called also the descending oblique muscle, from the direction of its fibres; it is situated at the side and front of the abdomen, and represents a broad flat plane of muscular and aponeurotic fibres. It is very broad at its anterior margin, for it extends from the ensiform cartilage to the pubes; the posterior border is very narrow, oblique in its direction, and composed of fleshy fibres, extended from the last rib down to the ilium; the upper border is irregularly curved, and composed of seven or eight angular points, termed digitations, which are interposed between similar processes of the serratus magnus and the latissimus dorsi. The first or highest of these digitations is very thin, but still is prolonged, so that its border becomes blended with the lower edge of the great pectoral muscle, whilst its extremity is fixed to the fifth or sixth rib, beneath the corresponding point of the great serratus muscle; the second, third, and sometimes the fourth fleshy points are broader than the first, whilst the three last are very narrow and pointed. The digitations in each case are observed to commence with very short white tendinous fibres, to which the fleshy fibres soon succeed, and are thence prolonged obliquely downwards and forwards; those of the five upper digitations run into the broad aponeurosis, by which they are continued onwards into the linea alba, whilst those of the three last are inserted into the anterior half of the haunch-bone (os ilii). The lower border of the muscle presents two parts: one fleshy, with a slight admixture of tendinous fibres, which are here seen inserted into the ilium; and the other tendinous, where the broad aponeurosis is stretched across from the prominent process (spinous) of the ilium to the pubes. This border, when detached from all its connexions, represents a flat tense band or cord, attached on the outside to the spine of the ilium, and on the inside to the spine of the pubes; by which arrangement provision is made for the passage of muscles, blood-vessels, and nerves downwards, from the abdomen into the thigh, through the space which intervenes between the under edge of the cord and the curved margin of the pelvic bones. From this circumstance the space is termed the crural arch; the lower

fibres of the aponeurosis will be observed, moreover, to separate from one another so as to leave between them an angular interval, which transmits the spermatic cord in the male, or the round ligament in the female. It is, in fact, the outlet of a canal formed by a very peculiar arrangement of the lower part of these three muscles, the inlet or inner aperture being in a thin membrane, which lines the inner surface of the transversalis muscle, and is distant from the one here delineated by about one inch and a half. Provision is thus made for the security of the abdominal viscera, and for the prevention of their protrusion, inasmuch as the two apertures just noticed are not directly opposed to one another, which would render the egress of parts comparatively easy. The arrangement here indicated gives to the canal such a degree of obliquity in its course as to enable it to act on the principle of a valve in preventing protrusions. The outer aperture through which the cord passes will be observed to be somewhat of an angular form, being bounded by the diverging fibres of the aponeurosis of the external oblique muscle as they proceed to their insertion. Upon the aponeurosis some fibres will be observed to rest, but which run in a different direction, viz. upwards and inwards. They are well marked towards the outer angle of the aperture, and as they are interwoven with the subjacent fibres, they have the effect not merely of strengthening them in a part which requires some additional security, but also preventing the enlargement of the aperture. These transverse fibres, moreover, are continued downwards upon the cord as it escapes from the opening, but there they gradually become thin, so as to represent a smooth membrane, which shades off the margins of the aperture so as to render them indistinct until it is removed by dissection. Where this structure is continued downwards, it assumes a membranous form, and becomes one of the coverings of the cord.

Now there is much of technical language employed in the description of the parts here noticed. The tense cord, which represents the lower margin of the external oblique muscle, is called *Poupart's ligament;* the aperture is called the *ring* (external abdominal), notwithstanding its angular form; the fibres which form its sides are called *pillars* (columnæ); the transverse curved fibres which run across are called *intercolumnar* fibres; and finally, where the latter are prolonged down upon the cord, and assume the form of a thin membrane, they are said to form the *fascia* of the cord, or the spermatic fascia.

PLATE XXIV.

Fig. 1. This drawing is intended to show the structure and the arrangement of the fibres of the intercostal muscles which fill up the spaces between the ribs, and assist materially in the respiratory movements. In each space there are two planes of fleshy and aponeurotic fibres, which differ in their direction, and also in the extent to which they are prolonged. The *external intercostal* muscle, or rather plane, of muscular fibres, No. 4, will be observed to have a direction downwards and forwards, from the lower margin of any given rib to the contiguous edge of that beneath it. Its extent is from opposite the transverse processes of the dorsal vertebræ to near the anterior extremities of the ribs, at which point the muscular fibres cease, and a thin layer of membrane is continued onwards to the sternum.

The *internal intercostal* muscle, placed under cover of the former, takes an opposite direction, the fibres running backwards and downwards, 5, 5; they may be said to commence at the sternum, to be

PLATE XXVI.

This drawing gives a posterior view of the sternum and ribs, which form a covering for the chest, and of the transversalis and recti muscles, as they lie over the abdomen; the clavicles and ribs are cut through towards their anterior third, the incision is then continued downwards through the three planes of abdominal muscles, and through the iliac bones; the anterior third of the walls of the trunk are thus detached and everted, in order to show at one view their under or posterior surface.

Nos. 1, 1. The clavicles. 2. The sternum. 3. The ensiform cartilage. 4. The pubic bones at their symphysis. 5, 5. The iliac bones. 6, 6. The triangular muscle of the sternum (m. triangularis sterni). 7. The deep or under surface of the rectus muscle of the abdomen, which is here brought into view by the removal of the back part of the sheath, which the internal oblique and transversalis muscles form for it. 8. The lower part of the rectus muscle of the left side, where it is left uncovered by the aponeuroses of the muscles. 9. The transversalis muscle of the right side. 10. The transversalis muscle of the left side. 11. Its aponeurosis.

Plate 26.

J. Walsh del.ª

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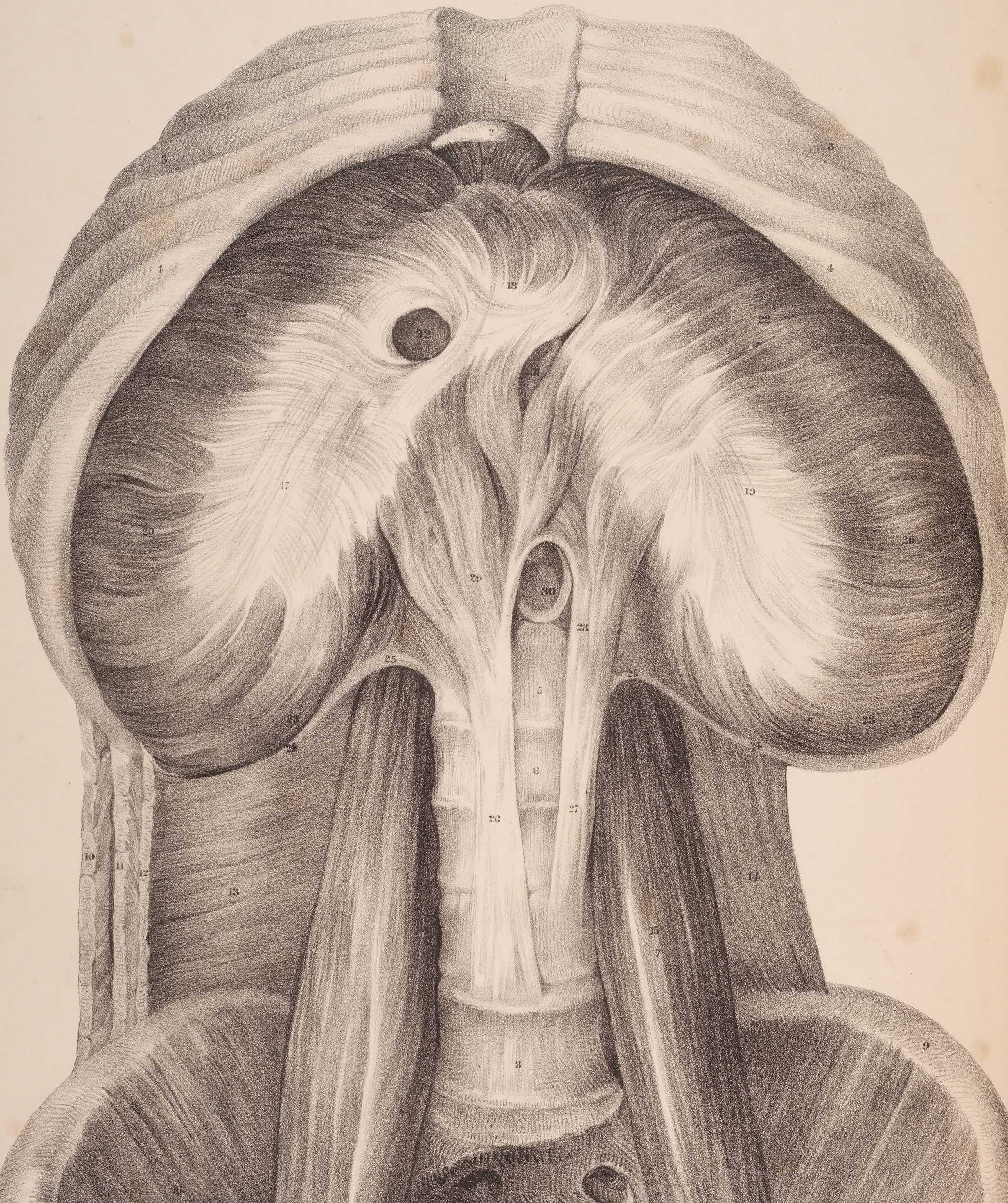
London, John Taylor, Upper Gower Street.

Plate 27.



Drawn by J. Walsh.

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Printed by Fairland.

attached by their extremities to the cartilages of the ribs, between which they lie, and to be then continued backwards between the bodies of the ribs themselves as far as their angles. Between the two planes of muscles here noticed, the intercostal nerves and vessels are placed. Their actions we shall notice when we comment on those of the Diaphragm.

Fig. 2. The second muscular layer which enters into the composition of the walls of the abdomen is here shown.

Fig. 2, No. 5. From its position, and from the direction of its fibres, this muscle is called the "internal oblique," and as most of its fibres incline upwards, it is not unfrequently called "obliquus ascendens." It is flat, broad, and thin, composed of fleshy fibres in a considerable part of its extent, but towards the fore part it becomes aponeurotic, No. 6; its fibres are attached along the crest of the ilium for two-thirds of its extent, and also to the outer two-thirds of Poupart's ligament; this extent represents the lower border, or, as it is commonly termed, the origin of the muscle. Along its upper edge it will be seen to be fixed to the cartilages of the ribs, from the twelfth to the seventh, inclusive. The muscular fibres will be observed to pass into a broad aponeurosis, which at the outer border of the rectus muscle divides into two layers, of which one passes before and the other behind the flat muscle just named, so as to enclose it in a sheath. At its inner border they unite again, and become blended with the fibres of the corresponding muscle of the opposite side, from the ensiform cartilage to the pubic bone. Now the layer of aponeurosis which passes in front of the rectus muscle becomes identified with that of the external oblique muscle, as in Plate XXIII, and that which passes behind the rectus unites with the aponeurosis of the transversalis muscle, as in Plate XXV. The arrangement here indicated exists as far as from the ensiform cartilage to midway between the umbilicus and the pubic bone, at which point both layers of the internal oblique, and also that of the transversalis muscle, pass in front of the rectus, Plate XXV, Nos. 9, 10, also Plate XXVI, No. 8, where the lower part of the rectus is left to show that the aponeuroses do not exist at its posterior or abdominal surface. The fibres of the internal oblique muscle which arise from Poupart's ligament become gradually thin and pale; they assume a direction downwards and inwards, arching over the spermatic cord, and become fixed to the crest of the pubic bone, and into that ridge upon it which is called the pectineal line. The latter part of the muscle becomes united with the subjacent fibres of the transversalis, and assume the name of conjoined fibres or tendons of these muscles. The posterior border of the muscle is narrow, as it corresponds with the interval between the crest of the ilium and the last rib; at this point the fleshy fibres become attached to the aponeurosis of the latissimus dorsi muscle, which

PLATE XXVII.

The structure of the diaphragm, and its different points of attachment, are here exhibited as they are seen from the cavity of the abdomen, after its soft parietes have been cut through and removed, together with the whole of its contained viscera.

No. 1. The sternum. 2. The ensiform cartilage. 3, 3. The ends of the true ribs. 4, 4. The cartilages of the false ribs. 5, 6, 7, 8. The lumbar part of the spine (7 is out of its place; it should rest on the spine, not on the psoas muscle). 9. The crest of the ilium. 10, 11, 12. The cut edges of the three layers of abdominal muscles of the right side, divided by an incision carried downwards from the ribs to the ilium. 13. The aponeurosis of the transversalis muscle, where it is prolonged inwards, and is about to form a sheath for the quadratus lumborum muscle. 14. The quadratus lumborum muscle of the left side, brought into view by the removal of the aponeurosis of the transversalis. 15. The great psoas muscle; it is seen to rest against the side of the lumbar vertebræ and to cross the brim of the pelvis, as it descends towards its insertion into the small trochanter of the thigh-bone; its upper end is crossed by the arched ligament (25) of the diaphragm (ligamentum arcuatum); it then overlaps the quadratus muscle whilst in the lumbar region, and the inner edge of the iliacus whilst crossing the pelvis; lower down it becomes inseparably united with the latter previous to its insertion. 16, 16. The iliac muscles, so named from resting upon the hollow of the iliac bones. 17. The right division, or leafet of the tendon of the diaphragm. 18, 19. The middle and the left divisions of the same. 20, 20. The muscular fibres of the diaphragm, where their direction is horizontal. 21. The anterior fibres of the same, their direction being backwards from the ensiform cartilage. 22, 22. The lateral part of the muscle, where the fibres are oblique. 23, 23. The deep or posterior part, the fibres of which pass forwards. 24, 24. The external arched ligament of the diaphragm; it is continuous with the anterior layer of the aponeurosis of the transversalis muscle, and gives attachment to the fibres last named of the diaphragm. 25, 25. The inner or proper arched ligament of the diaphragm (ligamentum arcuatum proprium). 26. The right crus or pillar of the diaphragm, commencing by a tendinous process from the lumbar vertebræ. 27. The left, or smaller crus. 28. The fleshy part of the left crus. 29. The fleshy part of the right crus. 30. The aorta passing down through the interval between the crura. 31. The œsophageal opening in the diaphgram. 32. The opening for the vena cava.

will be observed everted, in order to show the fascia here alluded to. At the lower part of the drawing a flat piece of white membrane will be observed turned out of its place and thrown down upon the thigh; it is a part of the aponeurosis of the external oblique muscle everted, in order to bring into view the relation which the lower border of the subjacent muscle bears to the cord.

The *cremaster* muscle rests upon the spermatic cord, and supports the testis, (κρεμαω, to suspend). It consists of a number of thin fibres disposed in curved lines, the concavities all looking upwards. They are indicated in Plates XXIII and XXIV; they are on the same plane as the lower border of the internal oblique muscle, and appear to have been originally continuous with it; their extremities have the same points of attachment, viz. to Poupart's ligament and the crest of the pubic bone, and they do not exist before the testis has descended. For these several reasons it may be considered a part of the internal oblique muscle drawn down with the testis, the direction of the fibres being determined by the traction exerted upon them during the descent of the organ just named.

PLATE XXV.

The third muscular layer of the abdomen is here exhibited, viz. the transversalis muscle, No. 7, with its aponeurosis, No. 8, and the relation of that aponeurosis to the rectus muscle, both in the upper two-thirds of its extent and in the lower third. The transversalis muscle, like the two oblique muscles previously noticed, consists of a broad thin plane of muscular and tendinous fibres. At first view its form appears to be triangular, one side being represented by the linea alba (14, 14) extending from the ensiform cartilage to the pubic bone; another side, by the cartilages of the ribs, No. 2; and the third by the crest of the ilium, No. 3, and by Poupart's ligament. However, when we examine the muscle farther back, in the interval between the last rib and the ilium, it does not terminate in a point; its fleshy fibres become continuous with a membrane which is prolonged backwards, and becomes attached to the lumbar vertebræ in a very peculiar way, after having formed a sheath for the quadratus lumborum muscle. The fleshy fibres of the muscle may be said to arise above from the cartilages of the ribs, from the seventh to the twelfth, by their inner edges; below, from the inner edge of the crest of the ilium in three-fourths of its extent, and from the outer half of Poupart's ligament; and finally, in the interval between the last rib and the ilium, from the fascia just alluded to, and which shall be more particularly described when commenting on Plate XXIX. The fleshy fibres proceed inwards and end in a broad aponeurosis, which soon becomes identified with the aponeurosis of the internal oblique muscle, with which it is prolonged to the linea alba, where it becomes blended with the fibres of the corresponding muscle of the opposite side, as well as with those of the oblique muscles, forming with them a seam, or common line of junction. The whole of the aponeurosis of the transversalis muscle lies behind the rectus muscle, in the upper two-thirds of its extent, No. 8, but passes in front of it in the lower third, No. 9; this relation is also indicated in Plate XXVI. The lower border of the muscle, No. 12, where it arises from Poupart's ligament, becomes rather thin and weak; its fibres incline inwards over the spermatic cord, previously to their insertion into the crest and pectineal line of the pubic bone.

The rectus or straight muscle of the abdomen is here shown, extending from the lower margin of the chest to the crest of the pubic bone, gradually becoming narrow towards its lower attachment; see also Plate XXVI, No. 7. Its upper attachment is effected by three points, of which one, the smallest, is fixed to the ensiform cartilage and the cartilage of the seventh rib; the second, to the cartilage of the sixth rib; and the third, to that of the fifth. The fibres, when traced downwards, will be found interrupted by two, three, or sometimes four zigzag tendinous lines (lineæ transversæ), which run across it, one of them being opposite the ensiform cartilage, one at the umbilicus, and the third in the interval between these; they are more distinct upon the anterior than the posterior surface. When traced downwards, the fibres of the muscle will be found to end in a flat tendon, which is inserted by two points into the upper edge of the pubic bone. The rectus muscle is enclosed in a sheath formed by the aponeurosis of the internal oblique muscle, which divides into two layers, so as to enclose it; the external layer being identified with and strengthened by the aponeurosis of the external oblique muscle, and the internal by that of the transversalis; but the sheath will be found deficient at its back part, towards the lower fourth or fifth of its extent, No. 8. Where the aponeurosis divides to enclose the rectus, it presents necessarily a curved line, corresponding with the outer border of the muscle, which is usually named linea semi-lunaris.

The *pyramidal* muscle (m. pyramidalis) is a small flat muscular bundle of a triangular form; when it exists, which is not always the case, it rests upon the lower extremity of the rectus muscle, is attached below to the pubic bone, near its symphysis, and above to the linea alba. Its surfaces are flat, the lower edge is tendinous and straight, the outer is oblique, the inner is also straight, the fibres being vertical, and parallel with the linea alba, close to which it lies, its power is necessarily very restricted; it may render the linea alba tense by drawing upon it.

Actions.—The three planes of muscular fibres here described are so arranged in the greater part of their extent as mutually to support and give strength to one another. The direction of the fibres of the internal oblique crosses that of the external, and that of the transversalis differs from both; hence, wherever this arrangement takes place, intestinal protrusions are prevented by the mode in which the fibres are super-imposed one upon the other. But towards the lower part of the abdomen, the fibres of all take nearly the same direction, being inclined downwards and inwards; there also, those of the internal oblique and transversalis become thin, and an interstice is moreover left beneath their lower margin for the transmission of the spermatic cord. Hence it is in this latter position that the intestines usually protrude, constituting hernia, or rupture. It would be limiting the use of these structures to say they serve merely to enclose and support the abdominal viscera. Their contracting power enables them to assist in many important functions, as well as in actions of the body; and as their position and points of attachment establish relations between them and the chest, the pelvis, and the cavity of the abdomen, we see how they can act upon either. Suppose their points of attachment to the chest and pelvis be rendered fixed by a preparatory effort of other moving powers, determined by the will, these muscles will be at once enabled to act upon the cavity of the abdomen, to diminish its capacity, and thereby the viscera it contains, particularly if an effort of inspiration be at the same time made, so that the diaphragm, as it descends, may force down the organs with which it is in contact. The combination of such movements as these is necessary in vomiting, and other expulsive efforts. The same agents, particularly the internal oblique and transversalis, can occasionally be made to compress the lower border of the chest, and thereby assist in expiration. When the lower attachment of these muscles becomes fixed, so as to give them a steady point from which to act, they can be made to move the trunk in various ways. Thus the two recti, by drawing on the lower part of the chest, can bend the body directly forwards, and so become flexors of the trunk. It will at once be perceived that the ribs into which they are fixed give them a great mechanical advantage in executing this office; for, as these bones project forwards from the spine, they resemble so many prolonged transverse processes, and in effect give to the muscles the mechanical advantage of levers, through the medium of which they can act upon the vertebral column. The two external oblique muscles can assist the recti in thus bending the body directly forwards, when both act together; but if either contracts by itself, it in the first instance tends to draw down the chest towards its own side, but a continuance of the effort enables it to turn the body upon its axis, and rotate it towards the opposite side; thus the right external oblique muscle rotates the body towards the left side, the centre of motion being in the lumbar vertebræ. If the chest be fixed, the oblique and recti muscles are enabled to concentrate their efforts upon the pelvis; this is exemplified in the ordinary effort of climbing, in which the arms are raised above the head and rendered fixed by seizing on some object; the ribs and chest are in the next place rendered motionless by taking a full inspiration, and by holding in the breath; then it is that the abdominal muscles can act upon the pelvis, and draw it upwards and forwards, thereby preparing for an upward movement of the legs. Though the moving powers here described are grouped together as belonging to the walls of the abdomen, sufficient has been said to show how important an influence they exert upon the thorax. The external oblique rests upon the same plane as the great serratus muscle, whilst the internal oblique and transversalis occupy the same relative position in the abdominal region which the intercostals do in the thoracic.

PLATE XVII.

This drawing is intended to exhibit the structure of the muscular partition, which in man and the higher animals separates the cavity of the chest from that of the abdomen; technically it is called the diaphragm (διαφραττω, to divide), and in popular language it is known as the midriff. To bring it fully into view, all the viscera of the abdominal cavity must be removed, and the coating which the lining membrane or peritoneum gives to this, as well as to other parts, must be carefully dissected off.

The vessels, too, which pass through it, as well as the œsophagus, are also cut across, in order that the form and position of the apertures which transmit them may be more distinctly seen. The great blood-vessels which lie upon the spine must also be taken away, in order to give a distinct view of the pointed processes (footstalks, "legs," or "crura," as they are technically called), by which the diaphragm is attached to the lumbar vertebræ. It is difficult to convey a correct or satisfactory impression of this structure by a single drawing, for its under surface, which is the one here seen, is concave, the upper surface being necessarily convex; moreover, the degrees of its curvature differ at the right and at the left sides, and they vary every moment of our lives, for, like a moveable floor, it descends with every inspiration which we make, and ascends with every expiration. This can be rendered clear only by a series of outline drawings, giving side views of sections of the body, which show at the same time the diaphragm in its different degrees of curvature, whilst it is descending in its contraction, and ascending in its relaxation; the import of these remarks will be more clearly perceived by reference to the different sketches given in Plate XXVIII.

When placing the parts as prepared by dissection, in order to take this drawing, the lower ribs were drawn a little upwards, and also spread out somewhat at the sides, in order to make the fibres of the diaphragm tense. This gives the ribs necessarily somewhat of a formal appearance; the ensiform cartilage (No. 2) is also drawn up in order to show the fibres which are attached to it. Now, when viewed in this way from below, we perceive at once how the diaphragm is attached all round the lower rim of the chest, its fleshy fibres being fixed to the inside of the cartilages of the ribs from the seventh or last true rib, down to the last (No. 24), at each side; a small bundle is also attached to the ensiform cartilage. Two tapering processes (crura, or legs), one of which is larger and longer than the other, rest on the spine, and are fixed to it; finally, at each side of the spine, where, from the interposition of the psoas muscles, its fibres cannot be directly connected with any osseous structure, they are attached to a curved ligament (No. 25), which arches outwards from the spine to the transverse process of the first lumbar vertebra. The structure of the diaphragm is partly muscular and partly aponeurotic, or tendinous; the fleshy fibres which form the broad part, and which commence at the margin of the chest, are seen to terminate in white glistening fibres, which are interwoven so as to form a firm resisting membrane. The direction of the muscular fibrillæ necessarily varies, so does their length; those from the sides run transversely inwards, those from before are very short, and pass backwards, whilst the posterior sets ascend and come forward. The white or tendinous part, known as the "cordiform tendon," presents a right and a left branch, as well as a middle one, which are sometimes spoken of as leafets, the whole being supposed to bear some resemblance to a trefoil leaf; the middle one, however, is here fore-shortened so much, and the shadow is thrown upon it in such a way, that it appears necessarily smaller and shorter than it really is. At the junction of the middle with

PLATE XXVIII.

The outline figures here given are intended to show the different states of the diaphragm, and the influence which its changes exert upon the size of the cavities of the chest and abdomen, also the manner in which it can assist in compressing the abdominal viscera.

Fig. 1. The diaphragm is seen in the relaxed state in which it projects up into the thorax, thereby lessening its perpendicular depth, and diminishing its capacity during expiration. The abdomen is at the same time proportionally increased.

Fig. 2. When the diaphragm descends during inspiration and increases the depth and the capacity of the chest, its curvature is lessened, for it approaches somewhat the state of an inclined plane. In its descent it also inclines forwards, which necessarily causes a certain degree of fullness at the umbilicus, towards which the abdominal viscera are pushed before it. This the drawing indicates.

Fig. 3. The curve of the upper surface of the diaphragm is sketched so as to show the difference in its degree at the right and left side. Also that it represents at once the floor of the chest and the roof of the abdomen.

Fig. 4. The manner in which the diaphragm and the abdominal muscles conspire to lessen the capacity of the abdomen is here shown. The oblique and transverse muscles, like broad belts, narrow its circumference, whilst the diaphragm presses downwards. When an effort is made to expel the contents of the intestinal canal, the body is inclined forwards, so that its axis may be made to coincide with that of the lower aperture of the pelvis. The fact is here expressed.

Fig. 5. This sketch shows how the diaphragm at times forces down the viscera towards the inguinal region, and may be the means of causing a hernia at one side or the other, according to the inclination which it is made to assume in different efforts. When, in lifting a heavy weight, a person inclines much towards the right side, as is here indicated, the viscera, particularly the small intestines, are pushed down towards the left groin, and if the resistance be not adequate, a protrusion is liable to occur.

Plate 28.

Fig 2.

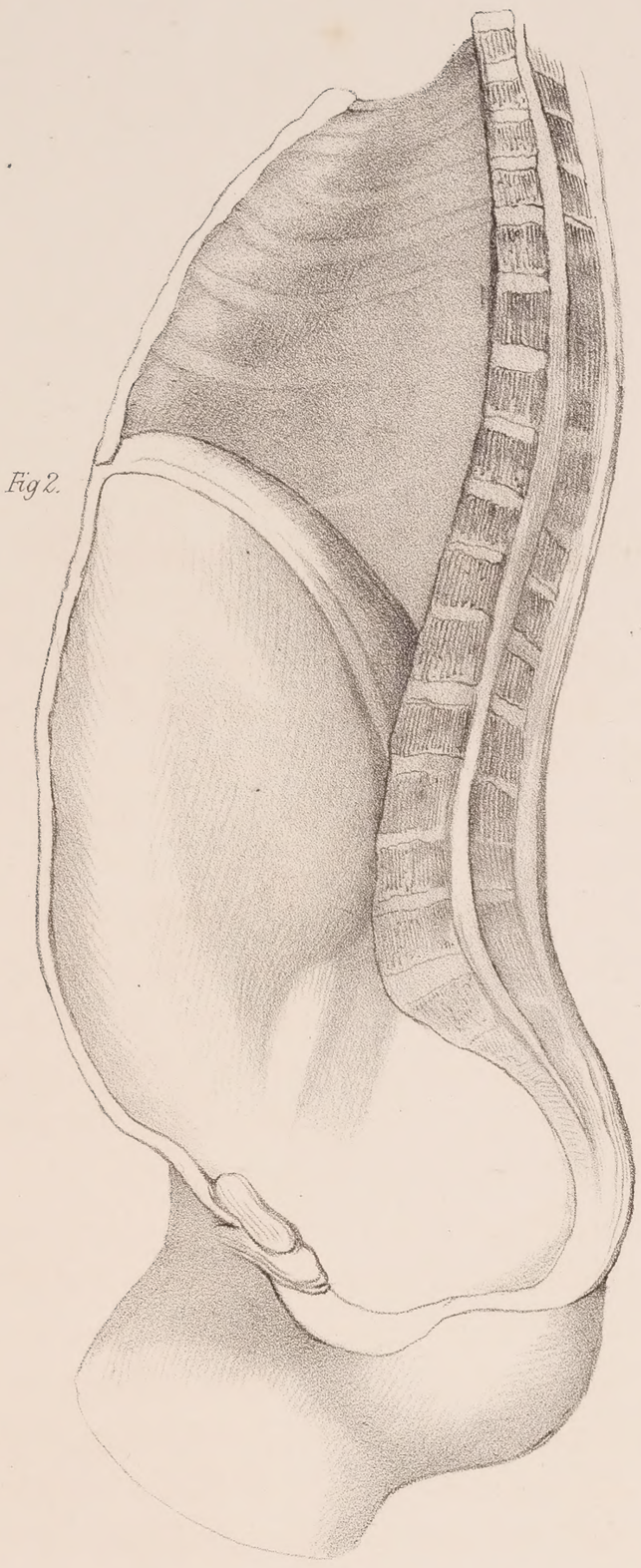


Fig 1.

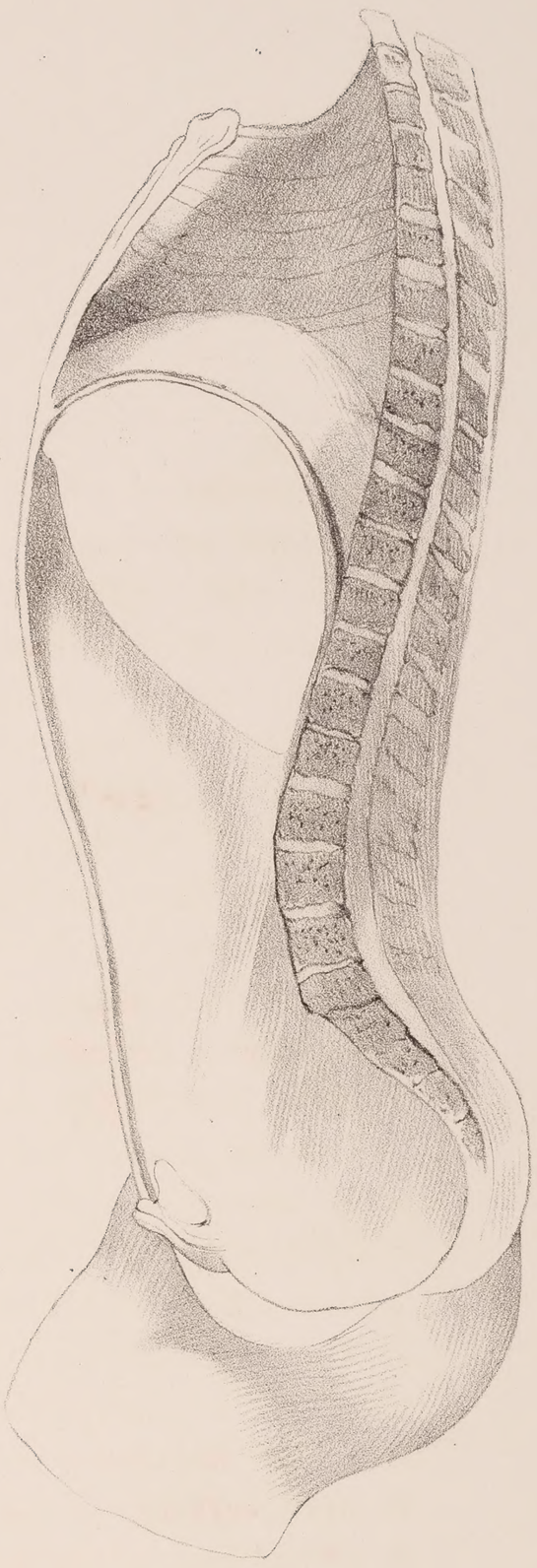


Fig 3.

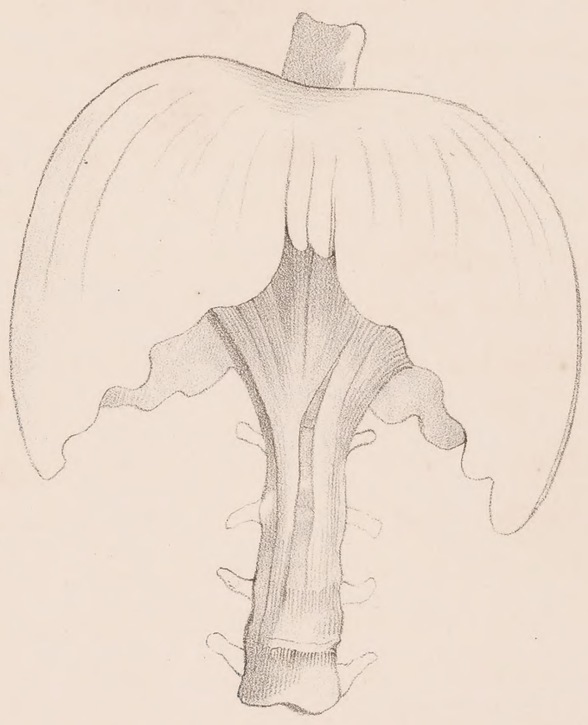


Fig 4.

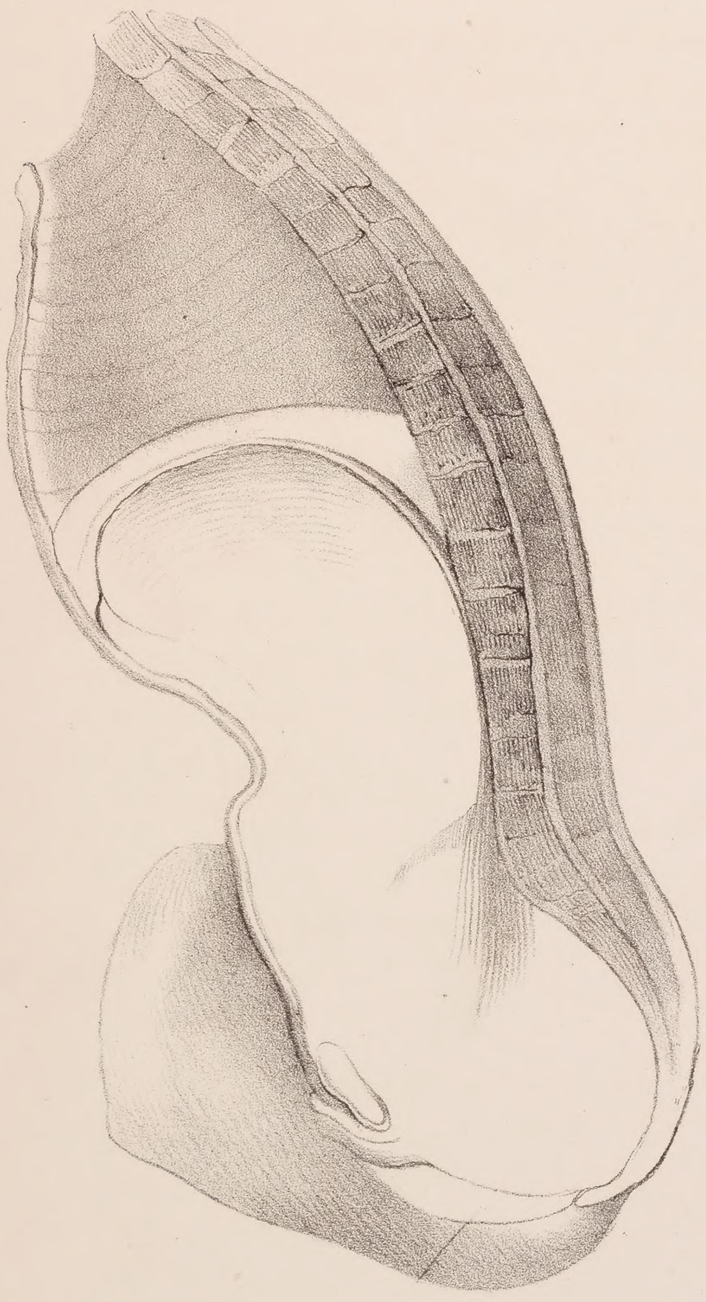
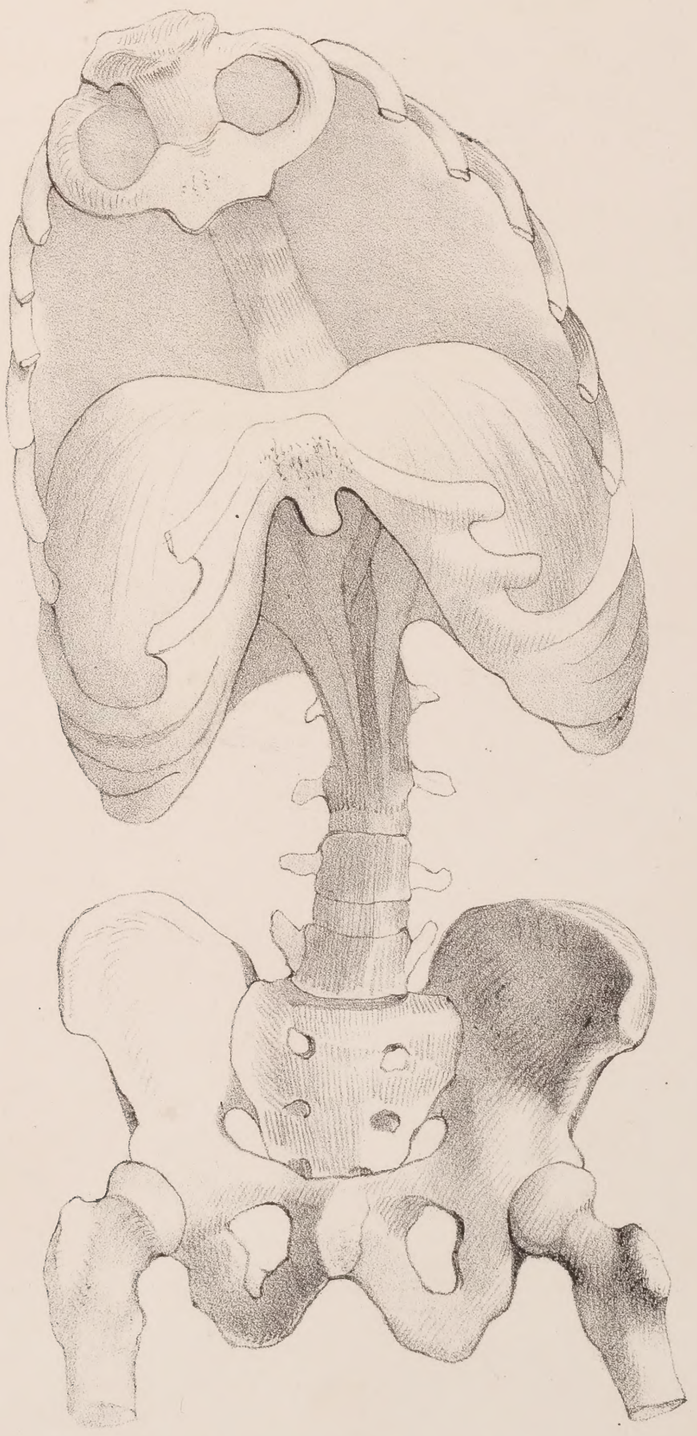


Fig 5.



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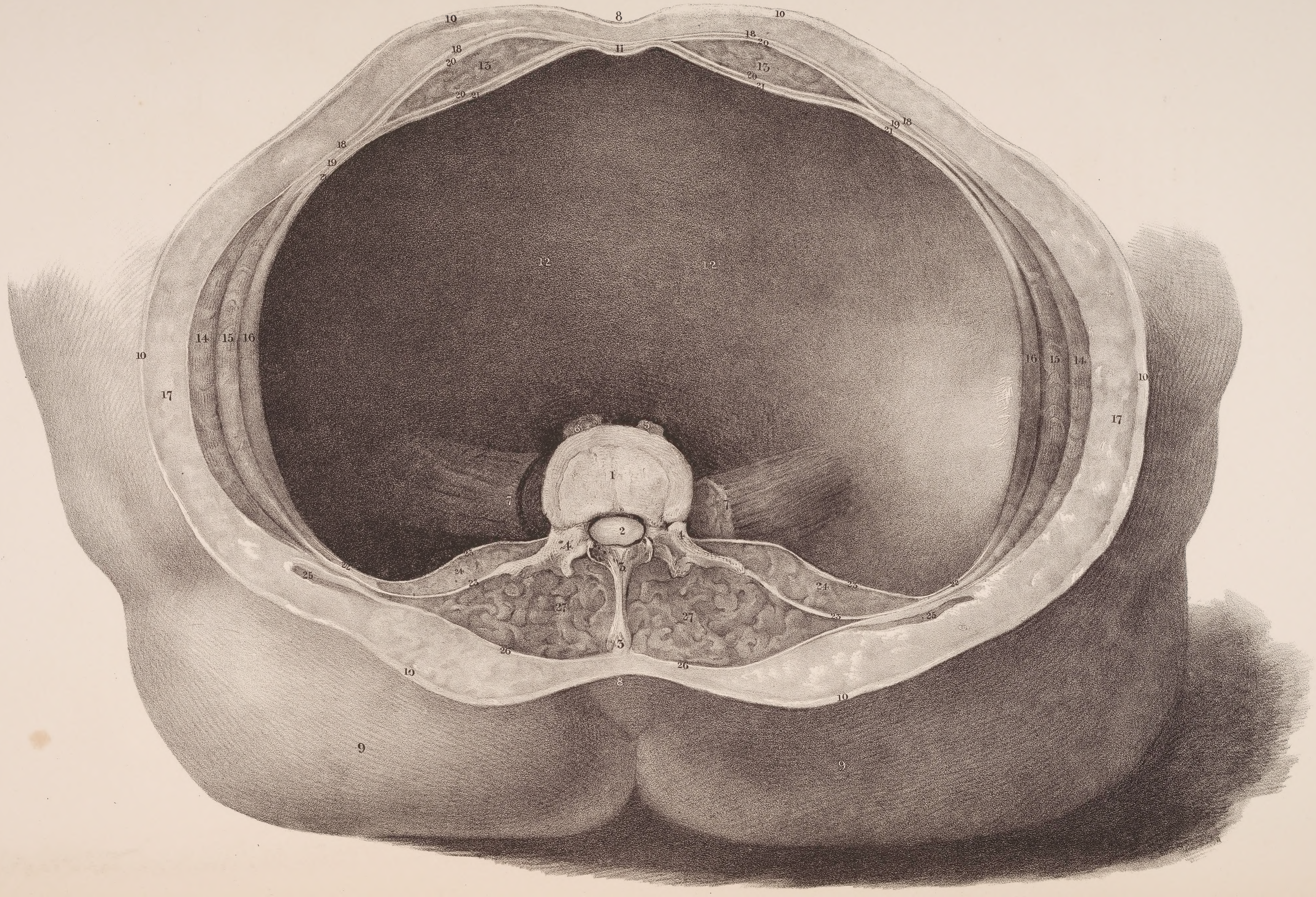
Wm. Fairland litho.

Plate 29.



the right division of the tendon a large square opening is observed (No. 32), which transmits the great vein (vena cava), that returns the blood from the lower parts of the body. Farther to the left and a little lower down is another opening (31), which gives passage to the œsophagus, or gullet, with the two great stomachic nerves (par vagum,—pneumogastric) ; it resembles a fissure, the long diameter of which is from above downwards ; it is, however, elliptical in its form and fleshy in its structure, its margins being formed by the muscular fibres of the crura as they ascend to be fixed into the central tendon. Still farther back and towards the central line is another opening, which resembles a canal or a tunnel placed between the crura (28, 29) ; it gives passage to the great artery (30) (the aorta), to a large vein (azygos), and to the principal trunk of the absorbing system (thoracic duct).

The lower surface of the diaphragm is in apposition with the liver, the spleen, the upper extremity of the stomach, and farther back it supports part of the kidneys and their capsules. Its prolonged part (crura) is also in relation with the great vessels — aorta and vena cava, with the pancreas and the duodenum. The upper surface is in apposition at each side with the lungs, and between these with the heart and the pericardium.

Actions.—The position and the structure of the diaphragm would lead us at first sight to class it amongst the involuntary muscles ; so also would the circumstance of its continuing to act when all volition is suspended during sleep or suppressed by an apoplectic seizure. Yet we are conscious of possessing a certain degree of control over its motions, for we can increase or diminish the extent of its movements, or hold it for a while at any particular state to which we have brought it by a previous effort. Seeing, then, that the muscle is thus allied to the two great classes of the voluntary and the involuntary, at the same time that it differs from each in some important particulars, we must associate it with those which form a group apart, and which are termed mixed muscles. The changes of position which the diaphragm undergoes, as it passes alternately from a state of relaxation to contraction, materially influence the relative size of the two great compartments of the body between which it is placed. In fig. 1, Plate XXVIII, the highest part of the curvature which its upper surface presents is on a level with the fourth intercostal space ; it is then relaxed, which is the state corresponding with expiration, the cavity of the thorax being at the same time necessarily diminished in every direction by the subsidence of the ribs and sternum, which takes place concurrently with the ascent of the diaphragm. But when we commence the effort of inspiration, the muscular fibres of the diaphragm contract and shorten themselves, so as to bring it down from the curved and arched state which it exhibits in fig. 1, to nearly that of an inclined plane as seen in fig. 2. By this movement the viscera of the abdomen are pushed obliquely downwards and forwards, as if towards the umbilicus, thereby diminishing the perpendicular depth of the abdomen, whilst that of the thorax is proportionally increased. Now as the ribs are at the same moment drawn upwards by the action of the intercostal muscles (Plate XXIV, fig. 1), their lower margins being at the same time slightly everted by a sort of twisting motion which they sustain, and as the sternum is pushed forward somewhat by the tendency of the

PLATE XXIX.

No. 1. The lower surface of one of the lumbar vertebræ. 2. The vertebral foramen. 3, 3. The root and apex of the spinous process. 4, 4. The transverse processes. 5, 6. The crura of the diaphragm cut across where they lie upon the interval between this vertebra and the one beneath it. 7, 7. The psoas muscle at each side cut across. 8, 8. The middle line of the body, corresponding in front to the linea alba, and behind to the lumbar spines. 9, 9. The integument covering the lower part of the loins and nates. 10, 10, 10, 10, 10, 10. The cut edge of the skin all round the trunk. 11. The linea alba, formed by the junction of the aponeuroses of the two oblique and transversalis muscles. 12, 12. The cavity of the abdomen deeply shaded to indicate its vacuity. 13, 13. The two recti muscles, lying one on each side of the linea alba, enclosed within their aponeurotic sheaths. 14, 14. The external oblique muscle of each side. 15, 15. The internal oblique muscle. 16, 16. The transversalis muscle. 17, 17. The layer of subcutaneous cellular and adipose substance interposed between the skin and the muscles. 18, 18. The aponeurosis of the external oblique muscle continued forwards to the linea alba. 19, 19. The aponeurosis of the internal oblique muscle. 20, 20. The two lamellæ into which this aponeurosis divides in order to enclose the rectus muscle. 21, 21. The aponeurosis of the transversalis muscle, prolonged inwards to the middle line behind the deeper seated layer of the aponeurosis of the internal oblique muscle, with which it becomes united. 22, 22. The posterior or lumbar aponeurosis of the transversalis muscle at each side. 23, 23. The two layers into which this aponeurosis divides so as to form a sheath for 24, the quadratus lumborum muscle. 25, 25. Part of the latissimus dorsi muscle at each side, cut across by the transverse section which has been made. 26, 26. The aponeurosis of the latissimus muscle continued back to the tip of the spinous process. 27, 27. The mass of the lumbar muscles, viz. sacro-lumbalis, longissimus dorsi, multifidus spinæ, as seen when divided by a transverse incision.

ribs to come more into a straight line with their cartilages, aided by the elasticity of the latter, which is brought into play, we can see at once how the capacity of the chest is increased in every direction, viz. from above downwards by the descent of the diaphragm, from before backwards by the protrusion of the sternum, and from side to side by the ascent of the ribs, and the eversion of their lower margins. This change in the capacity of the chest necessarily gives rise to a diminution of the pressure upon the organs which it contains, or, in other words, to a tendency to the production of a vacuum, and as the pressure remains undiminished upon all the other parts of the body, fluids will necessarily rush in and restore the equilibrium. It is in this way that the atmospheric air is made to pass through the mouth and air-passages downwards to the lungs, and may be said to be sucked into their vesicles. The same principle applies to the flow of venous blood. We see that it is retarded in its passage whilst the chest is contracted during expiration and the capacity of the lungs diminished, and that this obtains even in the case of the blood which flows in the veins of the neck and face, where its descent is not a little assisted by gravity. Still it accumulates and swells them in the state just noticed; but as soon as the inspiratory effort commences, and the cavity of the thorax thereby becomes increased, the venous blood finds a free passage towards the heart, being literally pumped into the chest by a mechanico-hydraulic contrivance.

The influence of the diaphragm upon the stomach and the other organs contained in the abdomen can be at once perceived, by paying a little attention to the sketch which is given of it, and of the muscles of the abdomen, in fig. 4, Plate XXVIII. If, whilst the diaphragm descends in inspiration, the oblique and transverse muscles of the abdomen be made to contract, the contained organs will be placed between two compressing agents, which will assist materially their own contractile powers, in propelling their contents either downwards, as in the different expulsive efforts, or upwards, as in vomiting.

PLATE XXVI.

The rectus muscle of the abdomen, 7, 8, and the transversalis, 9, 10, which are given in this drawing, have been already described in page 54. The flat thin muscle, 6, 6, which extends from the sternum to the ribs, and is in close apposition with their posterior or thoracic surface, requires to be briefly noticed. From its position, and the points to which its fibres are fixed, it may be termed *sterno-costal*, but is ordinarily named the *triangular* muscle of the sternum (m. triangularis sterni); it is thin and flat, and composed of a mixture of tendinous and fleshy fibres, the inner extremity of which is attached to the ensiform cartilage, and to the margin of the sternum as high up as the junction of the fourth costal cartilage, sometimes a little higher, whilst the outer end or insertion is fixed to the cartilages of the ribs, from the sixth to the third, or the second, as in the present case, forming thereby a series of points or digitations. The power of this muscle is necessarily very limited; its most obvious action is that of depressing or drawing down the cartilages of the ribs, by which means it assists in expiration.

PLATE XXVIII.

The five figures given in this plate are to be considered merely as sketches, or as diagrams employed in the illustration of the movement and actions of the diaphragm. The various points to which they refer have been sufficiently indicated in the remarks made upon the action of the diaphragm (pp. 57, 58), and in the references given at the foot of page 56.

PLATE XXIX.

This drawing is intended to represent the different layers of muscles which enclose and support the abdominal viscera. Instead of looking at them layer after layer, as they are seen ordinarily in dissection, and as they have been exhibited in the preceding plates, their relations to one another are here shown by means of a transverse section carried through the whole body about the middle of the lumbar region. When this was effected, all the viscera were removed, and a drawing made of the soft parietes of the abdomen. At the sides will be observed the fleshy part of the three broad muscles overlaying

one another; No. 14, 14, is the external oblique muscle of each side; 15, 15, the internal oblique muscle; 16, 16, the transversalis. Each of these is found, when traced forwards, to terminate in a white line which represents an aponeurotic membrane, which runs onwards from it to the fore part of the abdomen, where they all terminate, and become in a manner blended together, forming the linea alba, which we have previously described (p. 51). The white structures here noticed will be observed to form a sheath at each side which encloses the corresponding rectus muscle, 13, 13. The aponeurosis of the internal oblique muscle, 19, 19, on reaching the external border of the rectus, divides into two layers, 20, 20, which separate and diverge so as to leave between them an elliptic interval, which lodges the muscle. This aponeurosis it is which forms the immediate investment for the muscle just named. That layer of it, however, which passes in front of the rectus is further strengthened by the aponeurosis of the external oblique muscle, 18, 18, with which it becomes intimately united, so that their separation by dissection is rendered impracticable; and again, the deep-seated layer of the internal oblique, which passes behind the rectus, joins with and is strengthened by the aponeurosis of the transversalis muscle, 21, 21. At the inner margin of the recti muscles these different layers of aponeurosis coming from both sides will be observed to unite together at the linea alba, No. 11. The inside of the transversalis muscle is lined throughout by the serous membrane called peritoneum; towards the lower and fore part of the cavity it is supported by a thin layer of very different structure, called "fascia transversalis," which lying between the muscle and the peritoneum, represents a lining calculated to strengthen the abdominal parietes at the lower part, and to lessen the liability to intestinal protrusions. Between the layers of muscles, as here shown, two lines or interstices are observed, indicating the separation between them. This is effected by means of a thin stratum of cellular tissue, which is in intimate contact with each of the contiguous surfaces. Outside the external oblique muscle is a layer of cellular and adipose tissue, 17, 17, interposed between it and the common integument, 10, 10, from which circumstance it is commonly termed the sub-cutaneous cellular tissue. In some cases the quantity and thickness of this deposit are considerable, which is the case in the present instance; in others it is very thin, and contains no fatty matter. It may be traced upwards and downwards, forming a continuous layer all over the body: but in some places it becomes condensed or compressed into the form of a membranous layer, more or less firm; it is then named the "superficial fascia:" whilst in others it resembles a deposit intended to fill up interstices, viz. between muscles, in the ham and axilla.

Now at the posterior edges of two of these muscles certain aponeurotic layers are seen to extend backwards towards the spine, and to form connexions with it in such a way as to complete the circuit which encloses or circumscribes the abdominal cavity. Here too a sheath is formed at each side by the aponeurotic prolongations which enclose a muscle (24), constructed upon the same general principle as that which at the fore part surrounds the rectus; but there are points of difference which deserve notice. In the first place, the external oblique muscle has nothing to do with it, inasmuch as it terminates at the back part towards the lumbar region by a free margin which is altogether muscular in its structure, and consequently has no connexion with the aponeurotic bands which form the sheath just alluded to; secondly, the immediate investment of the muscle consists in this case of lamellæ given off from the transversalis muscle, and not from the internal oblique; lastly, it is much thinner, and its fibres are not so well developed as in the sheath of the rectus. The formation of the sheath may be thus stated:—the aponeurosis given off from the posterior edge of the transversalis muscle, 22, divides into two layers, 23, 23, at the outer edge of the quadratus lumborum muscle, 24, one passing anterior to it, and the other posterior; the former is prolonged inwards towards the spine, and becomes fixed near the root of the transverse process, 4, of each lumbar vertebra, whilst the other passes behind it, and reaches the apex of the transverse process. It is in the interval left between these two layers that the quadratus lumborum muscle is lodged. Now the posterior layer is intimately connected with the aponeurosis given off from the edge of the internal oblique muscle, and the latter in its turn contracting an adhesion to the aponeurosis of the latissimus dorsi muscle, is, conjointly with it, continued backwards in the form of a strong aponeurotic lamella, 26, which will be observed to reach the apex of the spinous process, No. 3, and there to be fixed. Between the lamella just noticed and that of the transversalis which goes to the apex of the transverse process, a considerable interval necessarily exists, which is filled up by the mass of the lumbar muscles.

PLATE XXX.

The quadratus muscle of the loins, *23*, *23*, exhibits some analogy to the scalenus in the neck, in so far as it bears the same relation to the last rib which the scalenus does to the first. The latter, from its points of attachment, may be termed the "costo-transverse" muscle, and the quadratus may be named "ilio-costal." Two muscles of this name will be observed to lie one at each side of the lumbar part of the spine, and to extend from the crest of the ilium, its posterior fifth, to the lower edge of the last rib, which constitute its fixed points, or, in other words, its origin and insertion. Its fibres incline inwards a little as they ascend; it is flat, pretty thick, and quadrilateral in its form, as its name implies. Its origin is effected by short aponeuroses, some of which will be observed to come not only from the ilium, but from the ilio-lumbar ligament; those which form its outer border pass upwards to the last rib, but those at the inner margin form four processes or points, which are attached by short aponeuroses to the summit of the transverse processes of the four upper lumbar vertebræ. In the drawing the anterior surface of the quadratus appears to be in immediate apposition with the psoas which lies in front of it, whilst its posterior surface appears to rest upon the mass of the lumbar muscles, *24*, *24*, that lie behind it; but it will be recollected that this muscle is enclosed in a sheath formed by the posterior aponeurosis of the transversalis muscle, (Plate XXIX, Nos. *23*, *23*), one lamella of which passes before it interposed between it and the psoas, whilst the other lies behind it and separates it from the lumbar muscles.

Actions.—The most obvious action of this pair of muscles is that of drawing down the last rib at each side, and rendering it fixed. When this is effected, the last intercostal muscle can be made to act upon the eleventh rib and depress it, which movement can be propagated simultaneously to the other ribs, by means of the intercostal muscles, so that all of them are together drawn downwards, and the capacity of the chest diminished. Thus the quadratus muscle may be made to commence a series of movements, all tending to effect a forcible expiration. Again, the separate points by which these muscles are fixed to the transverse processes of the lumbar vertebræ enable them to act upon the spinal column, so as to incline it now to one side, now to the other, or to steady and fix it when both act together. Their power in these particulars is not a little increased by their connexion with the last ribs, which may be regarded as two lengthened transverse processes, affording a longer lever with a proportionate increase of mechanical power to be directed upon the spine itself.

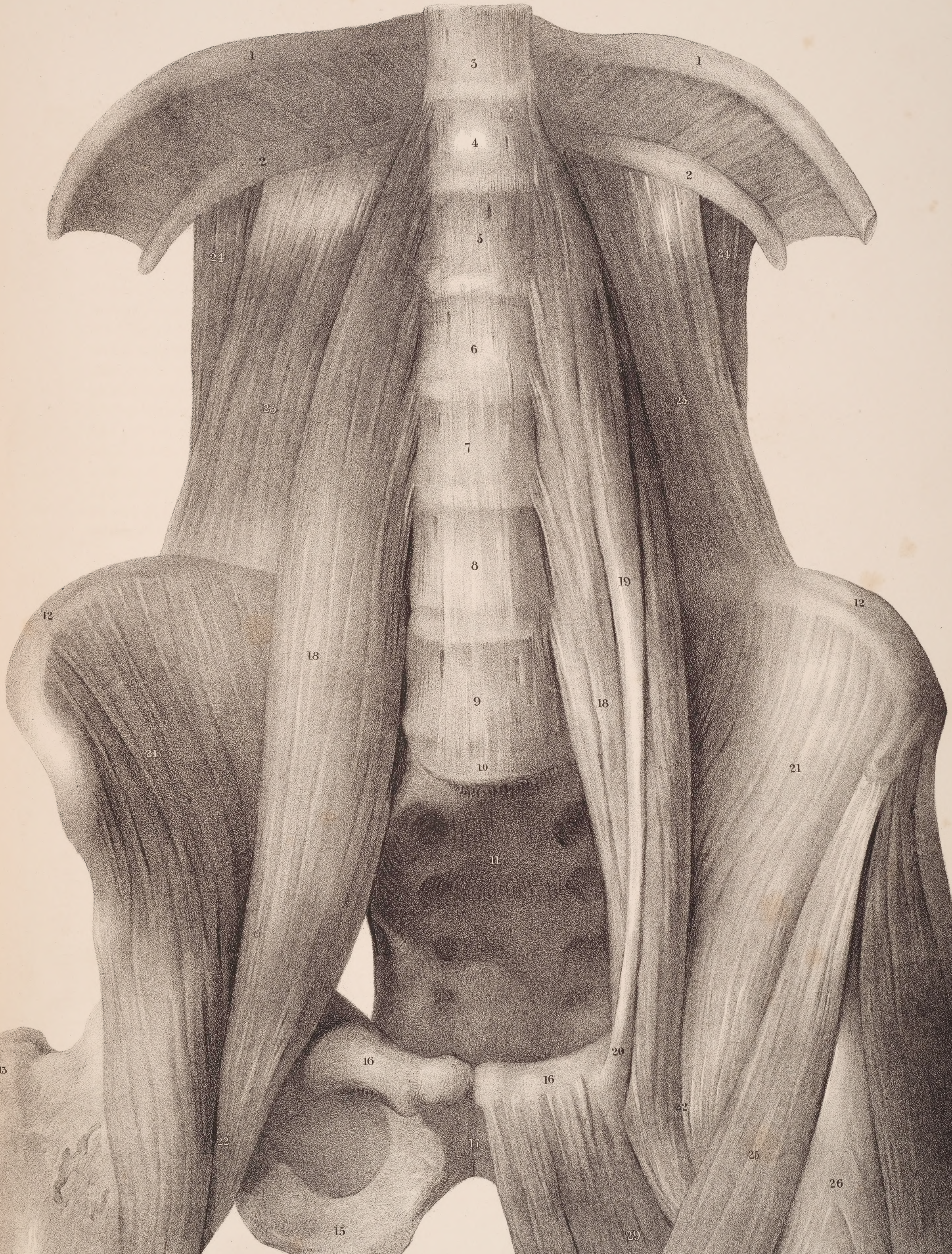
The great psoas, and the iliacus muscles, 18, 21, may be regarded as a single muscle, inasmuch as they are united, *22*, previously to their insertion; but the more usual practice is to describe each

PLATE XXX.

The muscles which lie at the sides of the lumbar part of the spine, and along the brim and fore part of the pelvis, are here exhibited, viz. the quadratus lumborum, the psoas major and minor, and the iliacus. As these muscles are deeply seated, being concealed by the abdominal viscera and their investing membrane, the quadratus being moreover covered by a special investment derived from the transversalis muscle, (Plate XXIX, No. 23,) and the iliacus also by a special membrane, called fascia iliaca,—all these organs and structures must necessarily be removed, in order to bring the muscles fairly into view.

Nos. 1, 1. The eleventh rib at each side.—2, 2. The twelfth rib.—3, 4. The eleventh and twelfth dorsal vertebræ.—5, 6, 7, 8, 9. The five lumbar vertebræ indicated in their order from above downwards.—10. The junction of the fifth lumbar vertebra with the top of the sacrum, forming a projecting angle (*sacro-vertebral*), and commonly termed the *promontory*.—11. The anterior concave or curved surface of the sacrum.—12, 12. The crest of the iliac bone at each side.—13. The great trochanter of the thigh-bone at the right side.—14, The upper part of the shaft of the right thigh-bone.—15. The ischium.—16, 16. The body of the pubic bone at each side.—17. The symphysis, or junction of these bones.—18, 18. The great psoas muscle at each side (prelombo-trochantinien, Chauss.)—19. The small psoas of the left side (psoas parvus).—20. Its tendinous insertion into the ilio-pectineal line; this muscle sometimes does not exist.—21, 21. The iliacus muscle of each side, where it rests upon the anterior or hollowed surface (fossa) of the iliac bone.—22, 22. The junction of the iliacus with the psoas at each side, by which means they become united into one previous to their insertion into the small trochanter of the thigh-bone.—23. The quadratus lumborum muscle.—24, 24. Part of the lumbo-dorsal muscles lying behind the quadratus.—25. Part of the sartorius muscle of the thigh.—26. Part of the rectus muscle.—27. The tensor muscle of the fascia of the thigh (tensor vaginæ femoris).—28. The fascia where it corresponds with the upper and outer part of the hip, forming an investment for the gluteus medius muscle.—29. Part of the pectineus muscle.—30. Part of the long adductor muscle.

Plate 30.



J. Walsh del.

William Fairland lith.

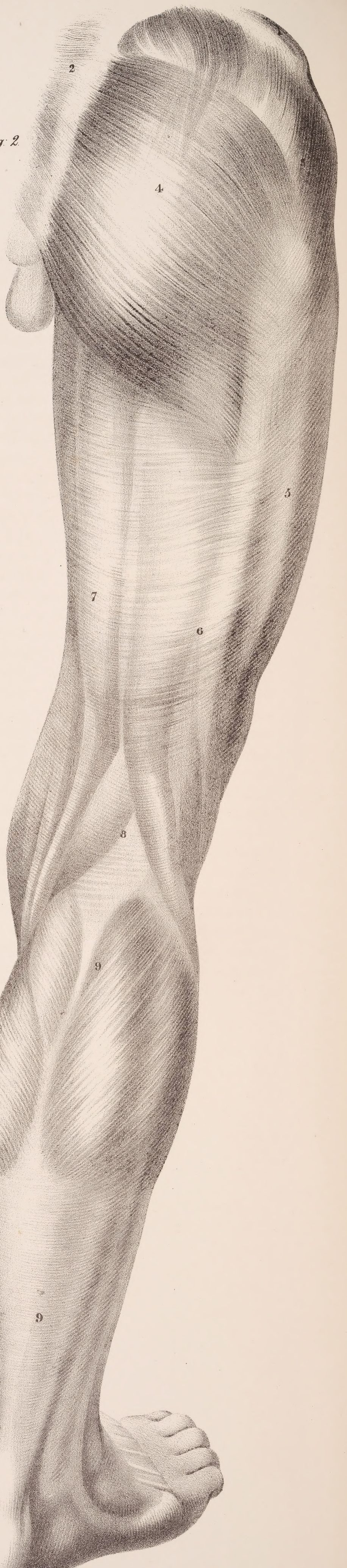
Printed by Graf & Soret.

London, John Taylor, Upper Gower St.

Plate 31.

Fig. 1.

Fig. 2.



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separately. The *great psoas* muscle (psoas magnus), No. 18, lies along the sides of the lumbar vertebræ, crosses the brim of the pelvis, and then descends into the thigh. It is therefore of considerable length, inasmuch as it reaches from the last dorsal vertebra to the small trochanter of the thigh bone, and may, if it were necessary to resort to much rigour in its description, be considered as divisible into three parts, which are here seen at a glance, viz. the lumbar, the pelvic, and the femoral. Its form is elongated, its anterior surface being rounded and convex, the posterior being compressed and flat; it tapers towards its extremities. Its fibres will be observed to arise by short aponeuroses from the sides of the bodies of the last dorsal vertebra, and of the four upper lumbar, also from the intervertebral fibro-cartilages; another set, more deeply seated, will be found attached to the transverse processes of the four lumbar vertebræ. The fibres of the muscles thus derived pass downwards, and altogether form a rounded thick fasciculus, which, passing over the brim of the pelvis, inclines outwards, downwards, and backwards, passing deeply into the upper and fore part of the thigh, where it is fixed to the small trochanter. The fleshy fibres of the psoas become fixed from point to point to the surface of the tendon, which is at first concealed between them, but afterwards becomes apparent towards the outer and fore part of the muscle, where it also gives attachment to a considerable number of the fibres of the iliacus, 22, 22. The anterior surface of the psoas corresponds at its upper extremity with the diaphragm, Plate 27, with the kidney and supra-renal capsule, with the smaller psoas when it exists, and the iliac fascia which covers it; with the femoral or crural arch, and the commencement of the femoral artery. The inner surface corresponds above with the spinal column, and lower down with the great iliac vessels.

The *iliac* muscle, 21, 21 (M. iliacus; iliaco-trochantinien), is so called from its relation and points of attachment to the ilium. The epithet "internal," or "anterior," is very commonly applied to it, which is no longer necessary, as the relative term "posterior," or "external," is no longer applied to any muscle. The pyriformis was at one time known as the posterior, or external, iliac muscle. The iliacus derives its form in a great degree, as well as its name, from the iliac bone, whose hollow or fossa it fills up; hence it is broad above, consisting of radiating fibres, and narrowed towards its lower extremity. It arises by short aponeuroses from the inner margin of the crest of the ilium (its anterior two-thirds), from the inner edge of the anterior spinous processes of the ilium (superior and inferior), and from that of the curved border of the bone between these points, also from the concave surface of the ilium by a great number of fleshy fibres, which are fixed to its upper three-fourths, and some are found attached to the broad part of the ilio-lumbar ligament. The fibres will be observed to incline inwards as they descend, and most of them become fixed to the outer edge of the tendon of the psoas. The fibres which correspond with the outer border of the iliacus descend lower down than the rest, and are inserted into the curved line which leads from the small trochanter of the thigh bone to the rough ridge on its back part (linea aspera). The anterior surface of this muscle is covered by the iliac fascia; is crossed by the crural arch, and lower down by the sartorius and pectineus muscles; its posterior surface rests on the iliac fossa, the brim of the pelvis, and the capsular ligament of the hip

PLATE XXXI.

Back and front views of the fascia of the thigh and leg are here given. The subjacent muscles are to a certain extent seen through it, the numbers indicate their position.

Fig. 1. No. 1. The anterior superior spinous process of the ilium. 2. The pubes. 3. Poupart's ligament. 4. The external abdominal ring with the spermatic cord passing through it. 5. The part of the fascia which covers the tensor vaginæ muscle. 6. The inner part which conceals the pectineus muscle. 7. The curved margin of the aperture [foramen saphenum] in the fascia for the transmission of the superficial vessels. 8. The lower part of the aperture where the vein enters. 9. The adductor longus. 10. The sartorius. 11. The rectus femoris. 12. The vastus externus. 13. The vastus internus. 13*. The fibres of the fascia passing upon the patella and its ligament; lower down they become attached to the head of the tibia, and finally continuous with that which covers the leg. 14. The fascia covering the tibialis anticus muscle. 15. The peronei. 16. The gastrocnemius. 17. The tibia. 18. The anterior annular ligament of the ankle. 19. The thin part of the fascia covering the extensor tendons upon the dorsum of the foot.

Fig. 2. No. 1. The crista of the ilium. 2. Part of the tendinous structures which cover the side of the sacrum. 3. The part of the fascia which conceals the gluteus medius muscle. 4. The gluteus maximus; here it is very thin, and the coarse fibres of the muscle are distinctly seen through it. 5. The position of the vastus externus. 6. The biceps flexor. 7. That of the semi-tendinosus and semi-membranosus. 8. The fascia stretched from the flexor muscles so as to cover in the popliteal space. 9, 9. The fascia where it covers the muscles of the calf of the leg and their tendon.

joint; its inner border, which is in close apposition with the psoas, is however separated from it by the anterior crural nerve, which is lodged in the groove between them.

As these muscles conjointly slide over the brim of the pelvis and the capsule of the hip joint, and as a free and easy motion is necessary in this situation, provision for this purpose has been made. A synovial sac of considerable extent lies between the posterior surface of the muscles and the parts just named, which secretes a lubricating fluid, and by its looseness admits of every movement that can be required.

The *small psoas* muscle (psoas parvus, No. 19), when it exists, which is not always the case, extends from the last dorsal vertebra to the brim of the pelvis resting upon the great psoas muscle. It is a flat thin fasciculus, composed in the upper third of its length of fleshy fibres, the rest being a narrow tendon. It arises by short aponeurotic fibres from the body of the last dorsal vertebra, and from the intervertebral substance which connects it with the first lumbar; and its tendon is fixed to the ilio-pectineal eminence, where it will be observed to widen previously to its termination.

Actions.—When the psoas and iliacus muscles of one side act together and take their fixed points above, they bend the thigh upon the pelvis, and at the same time rotate it outwards. This they are enabled to do by their passing so far backwards, and by the curve which they make previously to their insertion, as well as by the mechanical advantage which their connexion with the trochanter minor gives them. When the thigh bones are fixed, so that the muscles of both sides are enabled to act from below, they can be made to concentrate their force upon the spine and the pelvis, and when the muscles of opposite sides act together, they draw the spinal column forwards, and by continuing their effort become powerful agents in maintaining the body erect upon the legs. In the effort of standing on one leg also the psoas and iliacus act with great power in maintaining the pelvis and the spinal column erect, and in a manner poised upon the head of the thigh bone.

At the outside of the psoas, and in part overlaid by it, is a muscle (*23, 23*) of a very different form, being flat and compressed. This, from its shape and position, is usually called the square muscle of the loins, *quadratus lumborum;* and from its points of attachment it is sometimes named *ilio-costalis*, as it is fixed below to the ilium, No. 12, and above to the last rib, *2*. It is situated deeply in the lumbar region close to the vertebral column, and is of an irregular quadrilateral form, being broader below than above. It arises by tendinous fibres from the crista of the ilium for about one-fourth of its extent, and is inserted into the inferior border of the last rib for about half its length, and by four tendinous points into the transverse processes of the four superior lumbar vertebræ. This muscle is enclosed in a sheath (*sheath of the quadratus*), not unlike that of the rectus, but not so dense or firm in its structure. The posterior or lumbar aponeurosis of the transversalis muscle divides into two layers near the border of the quadratus, one of which is prolonged backward behind the latter muscle, to be attached to the apices of the transverse processes of the lumbar vertebræ, and the other before it, to be fixed at the roots of these processes. Now, the lower border of this layer is attached to the inner margin of the crista ilii (its posterior fourth), and the upper one is stretched across from the anterior surface of the last rib to the root of the transverse process of the first lumbar vertebra. This latter part, from its mode of attachment and relation to the broad muscle of the diaphragm, has been named by some ligamentum arcuatum externum.

The relation of this muscle to its sheath, and the mode in which this investment is formed, will be seen at once by referring to Plate XXIX. where *24* is the quadratus, and *23, 23*, the two layers of the sheath.

PLATE XXXI.

These drawings are intended to exhibit at one view a structure which forms the immediate investment of the muscles of the lower extremity. The outline of the muscles is indicated so as to convey to the mind the idea that they are covered by a thin veil drawn tightly upon them, allowing their form to be seen, but obscuring their colour and intimate texture. Most of the numbers are placed so as to indicate the position of the muscles as they lie under the membrane.

When the common integument has been dissected off and removed from the lower extremity, it will be found invested by another membrane of quite a different structure, being of a glistening white colour, close in its texture, and composed of fibres crossing in various directions. Anatomists

have classed it amongst the fibrous membranes, and named it the broad swathing band, *fascia lata*, of the thigh. The leg is enclosed in a similar investment, and so is the foot. But each presents certain peculiarities, which require a separate consideration.

The *facia lata* of the thigh may be considered as a special or immediate investment, which not only encloses it in its entire extent from the knee to the pelvis and Poupart's ligament, but also sends processes inwards in several situations, forming partitions between the muscles. The thickness of this membrane varies in different parts. It is considerable along the external side of the thigh, where it lies upon the vastus externus muscle, fig. 2, No. 5, and higher up upon the gluteus medius, No. 3; it is less so on its posterior aspect over the flexor muscles, fig. 2, No. 6, 7; but superiorly, and at the inner side, it is in some places so thin as to require great care in dissecting off the skin, else the fascia will be removed with it. When examined towards the lower part of the thigh, it is found to be prolonged over the knee-joint, and to be continuous with the fascia of the leg. It has at the same time a connexion more or less intimate with all the bony prominences round the articulation, viz. with the condyles at each side; with the patella, 13, and its ligament, in front; with the tuberosities of the tibia below; with the head of the fibula to the outer side, to which it is guided by the biceps muscle; and finally, after being stretched across the popliteal space, fig. 2, No. 8, it is prolonged over the gastrocnemius muscle, fig. 2, No. 9, and so becomes blended with the fascia of the leg at the back part.

When traced upwards, over the thigh, it is found not only to encase it, but also to send processes inwards between the muscles. The most dense and remarkable of these is one which passes in between the vastus externus and the short head of the biceps, fig. 2, No. 6, and is attached to the linea aspera in its whole length, as far as the insertion of the gluteus maximus. Along the internal side of the thigh it invests the muscles, and merely gives attachment to some thin cellular lamellæ, which lie between them; but along the course of the sartorius, fig. 1, No. 10, particularly in the lower two-thirds of its extent, an investment or sheath is formed for it, which serves to maintain it in its place, notwithstanding the obliquity of its direction.

Its points of attachment at the superior part of the limb are so numerous, that it becomes necessary to examine each of them in detail. Thus, externally, after having been intimately connected with the insertion of the gluteus maximus, it is prolonged backwards and upwards on the cutaneous surface of that muscle, fig. 2, No. 4; and though very thin and weak, it may with care still be traced as far as to the side of the sacrum and coccyx, and also to the crista of the ilium, to which it is firmly attached, after having passed over the upper part of the gluteus medius, fig. 2, No. 3. The fascia in the latter situation becomes very dense and firm, and is intimately connected with the fibres of that muscle. Still more externally, it divides into two lamellæ, which embrace the inferior termination of the tensor vaginæ femoris, fig. 1, No. 5, to which it in this manner gives insertion. These two lamellæ become united into one along the posterior border of the muscle, which, by being prolonged over the gluteus medius, (to whose fibres it gives attachment by its inner surface,) passes to be inserted into the crista of the ilium and its spinous process. Along the inner side of the thigh the fascia passes upwards over the adductor muscles, fig. 1, No. 9, and becomes attached to the tuberosity of the ischium and its ramus, as well as to that of the os pubis, as far as its spinous process. The most important part of the membrane — that which has claimed the greatest share of attention from anatomists and surgeons, remains now to be considered, namely, the part immediately below Poupart's ligament, and which extends from the spinous process of the ilium to that of the os pubis.

It will be recollected that the membrane forms an uninterrupted sheath for the limb, until it comes within a little more than an inch of Poupart's ligament, fig. 1, No. 3. There a division takes place, and an opening is established for the transmission of the superficial vessels. The superficial vein (vena saphena), in its whole course, from the inner ankle to the knee, and thence to the top of the thigh, lies superficial to the fascia. The superficial lymphatic vessels are similarly situated; the superficial epigastric vessels also descend over the abdominal muscles; and as all these converge to one point, in order to communicate with the deep-seated vessels, an opening must be established for them in the fascia lata. The existence of this opening (fig. 1, No. 8) has caused a division of the anterior portion of the fascia into two parts, one external, the other internal.

The *external* or *iliac* portion passes upwards, lying on a plane anterior to the vessels, and becomes blended with the lower border of Poupart's ligament, with which it continues to be thus united as far as the spinous process of the pubes. Whilst it is being prolonged in front of the femoral vessels, this part of the membrane, by reason of its inclination from below upwards and inwards, must necessarily present a curved or falciform appearance, fig. 1, No. 7, one extremity of it being at the lower border

of the opening, the other at the spinous process of the pubes. Now, as the membrane stretches between these two points, its border becomes folded on itself, not ceasing abruptly at the margin of the opening, as at first sight may appear. On the contrary, it is reflected on itself, and the reflected part becoming very thin, and degenerating into cellular tissue, passes outwards on the sheath of the deep femoral vessels, with which it is identified; but towards its superior termination it turns under the border of Poupart's ligament, and adheres to that of Gimbernat, with which it is inserted into the pectineal line.

The *pubic* or *inner* portion of the fascia, fig. 1, No. 6, so called from its situation, lies on the pectineus muscle, and therefore is on a plane posterior to the femoral vessels. Superiorly, it terminates at the pectineal line, to which it is guided, as it were, by the muscle of that name; externally, it passes behind the vessels and their sheath, and, on reaching the border of the psoas muscle and its tendon, divides into two lamellæ. Of these, one, rather dense and firm, passes deeply behind the tendon, and becomes attached to the fibrous capsule of the hip-joint; the other, lying more superficially, unites, along the border of the psoas magnus, with a membrane covering the muscle just named. This cannot be the fascia iliaca, as is usually stated. That membrane extends no farther than Poupart's ligament, in all that part between the spine of the ilium and the femoral vessels. In the rest of its extent, it forms part of the sheath of these vessels, behind which the pubic part of the fascia lata lies. The membranous structure then, with which the pubic part of the fascia lata becomes blended at the border of the psoas, is a deep-seated layer of the fascia lata, prolonged upwards upon the iliacus and psoas muscles, and which finally unites with the under surface of the fascia iliaca, where the latter turns forwards to be connected with Poupart's ligament.

The iliac and pubic parts of the fascia lata are continuous, and united at the lower border of the opening, which their junction serves to form, and over which slides the saphenous vein. Though the fascia, in the situation here referred to, appears to present a defined concave border (the concavity looking upwards), fig. 1, No. 8, it still will be found not to cease abruptly; on the contrary, it is folded on itself like the external margin of the opening, and reflected down on the sheath of the vessels, on which it is gradually lost. The oval aperture here described, from its transmitting the superficial vein (v. saphena), is called the *saphenous opening* (*foramen saphenum*) of the fascia lata.

The lower part of the limb, from the knee to the ankle, is encased by a membrane similar in structure and use to that of the thigh. Posteriorly it is continuous with that part of the latter which covers the popliteal space, fig. 2, No. 9, 8; externally it contracts a firm adherence to the head of the fibula, where it is strengthened by additional fibres, sent down by the biceps muscle; and internally it receives an expansion from the sartorius. If traced down from these different points, the fascia will be found to invest the muscles, and also to send processes inwards between them, more particularly between the extensor communis and tibialis anticus (fig. 1, No. 14) in front, and on the outside between the peroneal muscles, fig. 1, No. 15. These intermuscular septa serve to increase the

PLATE XXXII.

The superficial muscles at the front of the thigh are shown in Fig. 1. and those which lie deeply in Fig. 2.

Fig. 1. No. 1. The anterior superior spinous process of the ilium. 2. The pubes. 3. Part of the aponeurosis of the external oblique muscle of the abdomen. 4. The lower border of this aponeurosis, forming Poupart's ligament. 5. The tensor vaginæ muscle — its fleshy part. 6. Its lower extremity, where it is inserted into the fascia lata. 7. Part of the gluteus medius still covered by the fascia. 8. The sartorius muscle. 9. Its aponeurosis, where it spreads over the tendons of the gracilis and semi-tendinosus muscle, previously to its insertion. 10. The rectus femoris muscle. 11. Its tendon. 12. The patella. 13. The ligament of the patella. 14. Its insertion into the tubercle of the tibia. 15. The vastus externus muscle. 16. The vastus internus. 17. The psoas and iliacus muscles. 18. The pectineus. 19. The adductor longus. 20. The gracilis.

Fig. 2. No. 1. The crista and anterior superior spinous process of the ilium. 2. The anterior inferior spinous process. 3. The iliac fossa. 4. The ilio-pectineal eminence. 5. The upper surface of the os pubis. 6. Its angle. 7. The capsular ligament of the hip-joint covering the head and neck of the femur. 8. The trochanter major of the femur. 9. The trochanter minor. 10. The shaft or body of the femur. 11. Its inner condyle. 12. The outer condyle and tuberosity. 13. The adductor brevis muscle. 14. The adductor longus. 15, 15. The adductor magnus — its broad fleshy part forming a flat plane behind the two other adductors, which appears both above them and below them. 16. Its tendon, which is prolonged to the tuberosity upon the inner condyle. 17. The external obturator muscle. 18. The quadratus femoris muscle appearing just above the upper border of the adductor magnus (15), a slight fissure intervening.

Fig. 1.

Plate 32.

Fig. 2.

J. Walsh, del.

William Fairland, lith.

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Plate 33.

Fig. 1.

Fig. 2.

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William Farland lithog.
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number of points to which the muscles are attached; for it will be observed that their fibres arise from them, as well as from the inner surface of the fascia, for some way down the leg. The fascia is thin posteriorly over the gastrocnemius, fig. 2, No. 9; but is dense and firm where it covers the extensors, more particularly at the upper part; and will be found so firmly united along the anterior edge of the tibia, fig. 1, No. 17, that it cannot be detached so as to be traced over its cutaneous surface. If traced along the posterior aspect of the leg, the fascia will be observed to pass over the tendo Achillis, and to be connected with the malleoli at each side, and also with the fibrous sheaths which bind down the tendons passing behind them. At the inner side it joins the internal lateral ligament; externally it is continuous with the fascia covering the side of the foot, and in front becomes identified with the anterior fasciculus of the anterior annular ligament, fig. 1, No. 18.

The fasciæ of the foot consist of two parts, differing in density and texture as well as in situation, one being a dense fibrous structure, placed in the sole of the foot, the other a thin membrane covering its dorsum. Previously to examining the latter, it becomes necessary to describe a band of fibres which is strained across the bend of the ankle, and serves to bind down the tendons of the muscles.

The *anterior annular ligament*, fig. 1, No. 18, is attached by one extremity to the external malleolus and to the depression on the upper surface of the calcaneum, from which points the fibres of which it consists pass obliquely inwards, and divide into two fasciculi on reaching the border of the peroneus tertius and common extensor, one of them passing in front, the other behind the tendons of these muscles. At their inner border the fasciculi become united again, thus forming a tube or sheath for the transmission of the tendons. A similar arrangement of these fasciculi obtains as they cross the tendons of the extensor proprius pollicis and tibialis anticus, so that each is made to pass through a separate tube; and, finally, the fibres of the ligament, after having been thus successively separated and united again, are inserted into the internal malleolus. Now, the fasciculus of this band, or ligament, which lies in front of the tendons, is continuous by its upper border with the fascia of the leg, and by the lower with that on the dorsum of the foot, all three lying on the same plane beneath the skin. The *internal annular ligament* is attached, by one extremity, to the inner malleolus and the fibrous sheath of the muscles passing behind it, by the other to the inner margin of the calcaneum. Its superior border is continuous with the fascia of the leg, the inferior gives origin to part of the abductor pollicis; one surface is subcutaneous, the other is in contact with the vessels and tendons of the flexor muscles, which pass under cover of it into the sole of the foot.

The *fascia on the dorsum of the foot*, fig. 1, No. 19, is a thin lamella which covers the extensor tendons, being prolonged from the lower border of the annular ligament forwards to the digital phalanges. When traced towards the external border of the foot, it is found to be attached to the head of the fifth metatarsal bone. Behind this point it becomes blended with the corresponding margin of the

PLATE XXXIII.

These drawings exhibit the different muscles which lie at the back of the pelvis.

Fig. 1. No. 1. The back part of the sacrum covered by the aponeuroses of lumbar muscles. 2. The coccyx. 3, 3. The articulating processes of the last lumbar vertebra. 4, 4. Its transverse processes. 5, 5. The crista of the os ilium at each side. 6. The great sacro-sciatic ligament. 7. The tuber ischii. 8. The trochanter major. 9. The trochanter minor. 10. The shaft or body of the thigh-bone. 11. 11, 11. The great gluteus muscle (m. gluteus maximus); the references indicate its three attachments to the ilium, to the sacrum and coccyx, and to the great sacro-sciatic ligament. 12. The broad tendon in which the fleshy fibres of the great gluteus muscle end, and which, after sliding over the great trochanter, are inserted into the rough impression which lies beneath it. 13, at the right side, indicates the connexion between the insertion of the muscle and the fascia lata of the thigh; and 13,* at the left side, marks the line of insertion of the muscle into the thigh-bone. 14, 14. The second gluteus muscle (m. gluteus medius): at the right side part of it only is seen, the rest being concealed by the great gluteus muscle; but at the left side this portion is brought into view by the removal of the great gluteus muscle, part of the fascia which covers it is still left on at the upper third of its extent. 15. The tendon by which the gluteus medius is inserted into the trochanter major. 16. The pyriformis muscle. 17. The superior gemellus. 18. The obturator internus. 19. The inferior gemellus muscle. 20. Small part of the external obturator muscle (m. obturator externus). 21. The quadratus femoris muscle.

Fig. 2. No. 1. The crista of the os ilium. 2. Its posterior superior spinous process. 3. The back part of the sacrum. 4. The great sacro-sciatic ligament. 5. The small sacro-sciatic ligament. 6. The tuberosity of the ischium. 7. The trochanter major of the thigh-bone. 8. The broad part of the os ilium left uncovered by the removal of the gluteus medius muscle. 9. The third gluteus muscle (m. gluteus minimus). 10. The tendon by which it is inserted into the trochanter major. 11. The pyriformis muscle. 12. Its tendon. 13. The superior gemellus muscle. 14. The obturator internus muscle. 15. The inferior gemellus muscle. 16. Part of the obturator externus muscle. 17. Quadratus femoris.

plantar fascia, and before it, the membrane folds over the abductor and short flexor of the little toe, and unites with the digital process of the plantar fascia that lies beneath them. When traced along the inner border of the foot, we find the membrane passing over the fleshy fibres of the abductor pollicis. Posteriorly, it is attached to the calcaneum; but in all that part called the hollow of the foot, after covering the muscle just named, it is folded round its outer border, and, for part of its extent, passes deeply towards the tarsal bones, becoming blended with a septum sent upwards by the plantar fascia; farther forwards it unites with the first digital process of the fascia just named. The examination of the fascia in this situation is easily conducted by dissecting it from the tarsal bones, and tracing it over the border and plantar surface of the abductor muscle, when its termination and attachments will be found to be as above stated.

The *plantar fascia* is a dense fibrous structure, extended from the calcaneum to the heads of the metatarsal bones, along the sole of the foot. It is attached behind to the posterior tubercles on the plantar surface of the calcaneum, where its fibres (the greater number of which are longitudinal) are aggregated into a narrow thick fasciculus. From this point the fibres, as they proceed forwards, diverge and arrange themselves into two parts, separated by a depressed interval, one corresponding with the muscles of the little toe, the other with the middle of the tarsus, and the whole width of the metatarsus. The external, or narrow part, after being connected firmly with the fifth metatarsal bone, sends forwards some thin fibres which unite with the last digital process of the larger portion. By its outer border it gives attachment to the fascia of the dorsum of the foot, from the inner it sends a process upwards which contributes to form a septum between the plantar muscles. The broad portion of the fascia becomes thin as its fibres diverge, and ultimately resolves itself into five processes corresponding with the metatarsal bones. Each process, on reaching the digital extremity of these bones, divides into two fasciculi, which separate and become attached to their sides, thus leaving an angular interval for the transmission of the tendons and vessels to the phalanges of the toes. From each border of this part of the fascia a membranous partition is given off, which separates the mass of muscles placed in the middle of the foot from those that are situated along its borders and belong to the great and little toes.

PLATE XXXIII.

The muscles placed at the back of the hip are shown in these drawings just as they lie, layer after layer. At the right side, in fig. 1, the great gluteus muscle is brought into view by the removal of the skin and the fascia; at the left side of the same figure, the middle gluteus muscle, 14, of which part only is seen at the opposite side, is exposed by the removal of the great gluteus muscle. It is seen in its entire extent in Plate XXXIV, fig. 1, No. 13. Lower down are seen the external rotator muscles placed in a series one beneath the other, Nos. 16, 17, 18, 19, 20, 21. In fig. 2, in order to exhibit the third gluteus muscle, No. 9, the second muscle of that name is necessarily taken away: —We shall notice these separately.

The great gluteus muscle (m. gluteus maximus), fig. 1, No. 11, forms the prominence of the nates; its bulk and mass indicate at once the powerful action which it exerts. Its fibres are aggregated into thick and coarse fasciculi, and all are superficial, being covered merely by the skin and a thin layer of fascia. The direction of the fibres is oblique as they extend from above downwards and outwards; they are attached above to the pelvic bones, viz. the ilium, the sacrum, and the coccyx, by means of short tendinous fibres. The three attachments here indicated are marked in the drawing by three numbers, 11, 11, 11. The fleshy fibres will be observed to end in a broad tendon, No. 12, which slides over the great trochanter of the thigh-bone, and is fixed into a rough impression beneath it. The line of insertion of the muscle is indicated at the left side, No. 13*, where all the rest of the muscle is removed, its femoral attachment alone remaining. It will be observed that two of the borders of the muscle are fixed, and two are free and unattached, the upper one sliding in a manner over the gluteus medius, and the lower one, which forms the fold of the nates, overlaying the long flexor muscles, part of which is here shown. Where the gluteus slides over the great trochanter, provision is made for that degree of free motion which is necessary in this situation, by means of a large secreting membrane or synovial bursa, which lines the contiguous surfaces and enables them to slide smoothly one over the other.

The middle gluteus muscle (m. gluteus medius), No. 14, is seen only in part until the great

gluteus muscle is removed. When that is done, its lower part and its insertion, 15, are brought fully into view; it is of considerable extent, and by its mass is enabled to act with great power. Its fibres will be seen to take their points of attachment above upon the ilium, where they are in a manner expanded and radiating; they are fixed to almost every point of the crescent-shaped interval between the crest of the ilium and the origin of the third gluteus muscle, and which is shown in fig. 2, No. 8, where the bone is exposed by the removal of the muscle. The fibres of origin pass downwards and converge to a strong and broad tendon, No. 15, which is fixed into the upper border and external surface of the trochanter major.

The third gluteus muscle (gluteus minimus), fig. 2, No. 9, lies close upon the bone in its entire extent, and it cannot be seen until the others are removed; it is broad and expanded at its upper part where it is composed of fleshy fibres, but it gradually narrows where its fibres run into a tendon, No. 10, previous to its insertion. It is fixed above to the external surface of the ilium, and below to the anterior border and outer surface of the trochanter major.

According to that system of nomenclature which has been constructed on the principle of making the names of muscles express their points of attachment, the great gluteus muscle is called "Ilio-sacro-femoral," the next muscle of that name becomes the great "Ilio-trochanteric," and the third is the small "Ilio-trochanteric."

Actions.—These muscles are enabled to act upon the femur and upon the pelvis according as the one or the other becomes relatively the more fixed point. When they act from above and concentrate their effort upon the thigh, they are enabled to draw it outwards, or, in other words, they become abductors. The power of the great gluteus muscle in this particular is not a little increased by its being thrown outwards so far from the central line, where it slides over the great trochanter. Whilst executing this movement of abduction, the second and third glutei, by reason of the obliquity of their anterior and posterior fibres, are enabled to impress also a certain degree of rotatory motion upon the thigh-bone either forwards or backwards. Now, suppose the thighs to become the more fixed points, for instance in the standing posture; these muscles act upon the pelvis, and if the body is bent forwards as in the stooping posture, the great glutei, by acting upon the pelvis, draw it backwards, and retain it and the body erect upon the thighs. The bulk of these muscles is characteristic of the human subject; the only being which, in all particulars, is fitted to walk erect.

When the second and third glutei muscles take their fixed points below, and concentrate their effort upon their upper points of attachment, it is quite clear that they must influence the whole of the pelvis; for whatever motion is given to any one of its pieces is necessarily propagated to the rest, as they are all bound together and articulated with one another immoveably. Thus, in the effort to stand on one leg, the thigh-bone being rendered fixed, these two muscles act upon the pelvis and draw it in a manner outwards, so as to place it over the head of the bone, by which action they counterbalance the weight of the trunk, and maintain it erect upon the limb. Suppose this to be done at the left side, and the body be made to rest upon the left leg for an instant, if it be intended to advance a step, then the right leg will be carried, or in a manner swung forwards; the pelvis, and through it the whole body, being made to move as it were upon a pivot placed in the left hip joint. When in its turn the right leg is fixed upon the ground, the left is carried forwards in a similar manner, and the rotatory motion coinciding with its advance takes place in the right hip joint. In this way the centre of motion is changed from one joint to the other, and the sides of the pelvis are made to describe curves as they are alternately carried forwards in progression. It is this alternation of action in the muscles of opposite sides, and this change of the centre of motion from one joint to the other, which gives to the pelvis that sort of rotatory movement so perceptible in persons who walk irregularly, and which is so obvious in females in consequence of the great breadth of the pelvis.

External Rotator Muscles.—In figs. 1 and 2, Plate XXXIII; and in fig. 1, Plate XXXIV, six small muscles will be observed extending from the pelvis outwards to the upper part of the thigh-bone. They are all deeply seated, being concealed by the great gluteus muscle. These conspire in their action upon the thigh-bone; for they draw the great trochanter, No. 8, towards the tuberosity of the ischium, 7, as will be seen by referring to fig. 1; but as the neck of the bone prevents a direct approximation, a rotatory motion is given to its shaft, by which the whole limb is turned outwards, hence these muscles are named the external rotators of the thigh.

The pyriform muscle, (m. pyriformis; pyramidalis,) fig. 1, No. 16; fig. 2, No. 11, is seen immediately below the border of the second gluteus muscle; it is tapering in its form, a fact which is expressed by its name. Its upper part or origin lies within the pelvis, its fibres being attached to the anterior surface of the sacrum, as may be seen by referring to Plate XXXIV, fig. 2, No. 11. This part

of the muscle, which is termed its origin, is broad and fleshy; its fibres incline outwards and downwards, so as to pass out of the pelvic cavity through the great sacro-sciatic notch, and still continuing the same direction, they become narrowed into a tendon, which is inserted into the posterior border of the great trochanter of the thigh-bone, or into the upper part of the digital fossa immediately above the gemelli.

The two gemelli muscles are seen in fig. 1, Nos. 17, 19; fig. 2, Nos. 13, 15; and Plate XXXIV, fig. 1, Nos. 16, 18; these are small, narrow, and short muscles, which extend outwards from the ischium to the pit or fossa under the posterior margin of the great trochanter, enclosing between their contiguous margins part of the internal obturator muscle, fig. 1, No. 18; fig. 2, No. 14. The upper gemellus arises from the spinous process of the ischium, and the lower one from its tuberosity. As they pass outwards, each becomes narrow and tendinous, and at the same time contracts a more intimate connexion, or rather union, with the obturator muscle which lies between them, all three becoming inserted together into the fossa above indicated.

The internal obturator muscle (m. obturator internus), fig. 1, No. 18; fig. 2, No. 14, is seen only in part in these drawings, the rest of it being concealed within the pelvis. When this cavity is laid open so as to obtain a side view of its interior, as in Plate XXXIV, fig. 2, No. 10, the muscle will be observed to be broad and expanded, its fibres being attached to a considerable extent along the side of the pelvis, for they are fixed to the inner surface of the os pubis, also to the obturator ligament, and to the ischium nearly as far back as the margin of the great sciatic notch. From these points they converge as they pass outwards, in order to issue from the pelvic cavity, through the lower or small sciatic notch. In this situation the direction of the muscle becomes changed, for it runs outwards and forwards, lying between the two gemelli, together with which it is inserted into the digital or trochanteric fossa in the upper part of the thigh-bone. This muscle acquires considerable increase of power by the change in its direction, for as it slides smoothly upon the border of the ischium, it moves upon a pulley-like surface, and in its action works with all the advantage which such a contrivance can give it.

The square muscle (m. quadratus femoris), fig. 1, No. 21; fig. 2, No. 17, stretches outwards from the border of the tuber ischii, and is inserted into the posterior margin of the great trochanter; it is short, compressed, and flat, its form being that of an oblong square, and, as to its structure, it is almost all fleshy, there being but a slight admixture of tendinous fibres even at its attachments.

PLATE XXXIV.

Fig. 1. No. 1, 1. The crista of the os ilium. 2. Its anterior superior spinous process. 3. The posterior superior spinous process. 4. The rough part of the os ilium which gives attachment to the great gluteus muscle. 5. The sacrum. 6. The coccyx. 7. The tuberosity of the ischium. 8. The great sacro-sciatic ligament. 9. The small sacro-sciatic ligament. 10. The great trochanter of the thigh-bone. 11. The small trochanter. 12. Part of the shaft of the bone. 13. The middle gluteus muscle (m. gluteus medius). 14. Its tendinous insertion into the trochanter major. 15. The pyriformis muscle. 16. The superior gemellus. 17. The obturator internus. 18. The inferior gemellus muscle. 19. The obturator externus muscle.

Fig. 2. No. 1, 1. The crista of the os ilium. 2. Its anterior superior spinous process. 3. The anterior inferior spinous process. 4. The hollow of the os ilium (fossa iliaca). 5. The margin of the true pelvis. 6, 6, 6. The sacrum, its different pieces divided in the middle line. 7. The coccyx. 8. The great sacro-sciatic ligament. 9. The tuberosity of the ischium. 10. The internal obturator muscle (m. obturator internus), arising within the cavity of the pelvis, and passing out by the lower sacro-sciatic notch to be inserted into the trochanteric fossa of the thigh-bone between the two gemelli muscles; (see fig. 1, where 17 represents the external or reflected part of the obturator muscle as it lies between the gemellus superior, 16, and gemellus inferior, 18.) 11. The pyriformis muscle arising from the sacrum within the cavity of the pelvis, out of which it passes by the great sacro-sciatic notch to be inserted into the trochanteric fossa above the gemellus superior. (In fig. 1, 15 represents the external part of the pyriformis muscle.) 12. The coccygeus muscle.

Fig. 3. No. 1. The crista of the ilium. 2. Its anterior superior spinous process. 3. Its concavity or fossa. 4. The transverse process of the last lumbar vertebra. 5. The ilio-vertebral ligament. 6. The ilio-sacral ligament. 7. The body of the os pubis. 8. The ilio-pectineal eminence. 9. The inner edge of the os pubis which forms its symphysis. 10. The ramus of the os pubis joining with that of the ischium. 11. The tuberosity of the ischium. 12. The trochanter major of the thigh-bone. 13. Part of the shaft of the thigh-bone. 14. The external obturator muscle (m. obturator externus), which is broad and expanded at its origin, and gradually narrows as it passes behind the neck of the thigh-bone to be inserted into the lower part of the trochanteric fossa. (In fig. 1, No. 19 represents the prolonged part of the obturator externus muscle lying beneath the inferior gemellus.) 15. The quadratus femoris muscle. 16. Part of the anterior edge of the gluteus medius muscle. 17. Part of the gluteus minimus muscle.

Plate 34.

Fig. 1.

Fig. 2.

Fig. 3.

William Fairland lith.

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Plate 35.

Fig. 2.

Fig. 1.

J. Walsh del.ᵇ

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The external obturator muscle (m. obturator externus) is seen only in a small part of its extent in plate XXXIII. fig. 1, No. 20, fig. 2, No. 16 ; this is owing to the manner in which the muscle passes from the front of the pelvis behind the neck of the thigh-bone to reach its point of insertion, viz. the trochanteric fossa. By referring to plate XXXIV. fig. 3, No. 14, the position, form, and general direction of the muscle will be seen : it lies very deeply, being covered by all the muscles at the upper and inner part of the thigh ; its direction is transversely outwards, its structure fleshy in the greater part of its extent, but it ends in a tendon previously to its insertion, and, at its origin, there are a few aponeurotic fibres. It is broad and expanded where it is attached to the pelvis, its fibres being fixed to the external flat surface of the os pubis, to the rami of the os pubis and ischium, and to part of the ligament which fills up the obturator foramen. As the fibres incline outwards they gradually become aggregated together so as to form a thick and narrow fasciculus, which necessarily is directed behind the neck of the thigh-bone, in order to reach the point of insertion above indicated.

Actions.—The six muscles included in this group conspire in their action upon the thigh-bone : they run outwards, so that the direction of the fibres in most of them forms a right angle with that of the shaft of the femur ; this, together with the mechanical advantage given them by the length of the neck of the femur, enables them to concentrate their effort with much effect, so as to turn the whole limb upon its axis, and rotate it outwards. In their direction and mode of action, the muscles of this group bear a very close resemblance to those which are placed upon the back of the scapula, and are inserted into the great tuberosity of the os humeri.

On reviewing the muscles exhibited in these drawings, it will at once be observed how many provisions there are for turning the thigh outwards. The psoas and iliacus muscles, which we have exhibited in a former number, are also to a certain extent rotators ; and even the adductors of the thigh can turn the femur somewhat on its axis, and incline it outwards. Now, when so many moving powers conspire to produce such a result as this, it will be asked what are their opponents ? We find that the antagonizing powers are few, and comparatively feeble. The tensor vaginæ femoris is enabled, by its peculiar direction and mode of connexion with the fascia lata, to act upon the thigh, and rotate it inwards, and the anterior fibres of the gluteus medius muscle assist in producing the like result by reason of their oblique direction, and their insertion into the great trochanter. These are the only antagonists to the external rotator muscles, and accordingly we find that the power of turning the limb inwards is comparatively feeble, and that the effort is made with something of restraint, if not with awkwardness.

PLATE XXXV.

Fig. 1. No. 1. The crest of the ilium. 2. Its anterior superior spinous process. 3. The tendinous origin of the sartorius muscle (m. couturier). 4. Its fleshy part. 5. The upper surface of the body of the os pubis. 6. Its angle. 7. The pectineus muscle. 8. The long adductor muscle (m. premier adducteur). 9. The tensor vaginæ femoris muscle. 10. Its lower part, where it becomes inserted into the fascia lata of the thigh. 11. The anterior part of the gluteus medius muscle (m. moyen fessier). 12. Its tendinous insertion into the trochanter major. 13. Part of the gluteus maximus muscle (m. grand fessier). 14. Its tendon of insertion into the femur. 15. The middle fleshy part or body of the rectus femoris muscle (m. droit anterieur). 16. Its tendon passing down to be inserted into, 17, the patella ; 18. part of the vastus internus muscle ; 19. the vastus externus muscle : both these are seen to unite at their lower part with the tendon of the rectus muscle. 20. The long head of the biceps flexor cruris muscle. 21. The short head of the same muscle. 22. Its tendon of insertion where it becomes fixed to the head of the fibula. 23. The external head of the gastrocnemius muscle.

Fig. 2. No. 1. The external surface or dorsum of the ilium. 2. The trochanter major of the thigh-bone. 3. The tuberosity of the ischium. 4. The great sacro-sciatic ligament. 5. The superior gemellus muscle. 6. The internal obturator muscle. 7. The inferior gemellus muscle. 8. The quadratus femoris muscle. 9. The insertion of the great gluteus muscle : its fibres are shown as if cut off close to the bone, in order that its position at this point, and its relations to the adductor magnus and the vastus externus, may be clearly seen. 10, 10. The vastus externus muscle : the two references indicate its upper and lower part, for it extends from the base of the trochanter to the patella. 11. The long head of the biceps flexor cruris muscle. 12, 12. The short head of the same muscle ; its fibres are seen to project, in this view, at each side of the tendon of the long head, into which they become inserted. 13. The tendon of the biceps flexor muscle near its insertion into the head of the fibula. 14. The semi-tendinosus muscle. 15. Its tendon. 16, 16. The semi-membranosus muscle, which is broader than the preceding, and projects on each side of it. 17. The tendon of the semi-membranosus muscle. 18. The posterior ligament of the knee-joint. 19. The gracilis muscle (m. droit interne). 20. Its tendon. 21. Part of the sartorius muscle. 22, 22. The upper part of the adductor magnus muscle.

PLATE XXXIV.

The muscles exhibited in this plate have been already described with the two groups above noticed, viz. the glutei, and the external rotators; their names are given in the references at the foot of the page. One muscle, however, is here shown, which does not belong to either set, as it forms part of the deep perinæal, which we shall have to notice in a subsequent number: it is the coccygeus, fig. 2, No. 12; it may be called ischio-coccygeus, so as to make its name express the points to which it is attached. It is a flat triangular muscle placed at the outlet of the pelvic cavity at its outer and back part, which it assists in some degree to close, by being stretched from the spinous process of the ischium to the side of the coccyx, and the contiguous part of the edge of the sacrum; it is composed of tendinous and fleshy fibres, and is so placed that its inner surface supports the rectum, and the external one is covered by the lesser sacro-sciatic ligament.

Dislocations of the Hip-joint.—We can scarcely dwell for any length of time upon the lines of direction of the different muscles round a joint, and their points of attachment to the bones which form it, without making an endeavour to determine what their several and combined actions are in the natural condition of the parts; and when we have made this step, and have fixed in our mind an accurate conception of the powers and influences of the muscles, we are insensibly led to inquire what is their state and condition when one of the bones is displaced. It is obvious that the muscles under such circumstances are thrown into a new relation with regard to the joint;—the line of direction of some is changed; the fibres of one set are put upon the stretch in consequence of their points of attachment being farther apart in the new position of the bones than previously; and this may be carried so far in particular instances, that laceration of the muscular structure, or of the tendons, may be produced. In other cases, on the contrary, the muscular fibres are relaxed, owing to their points of attachment being approximated. These various conditions of the muscles influence the state of the limb, and determine its line of direction, as well as the aspect and outline which the neighbouring region of the joint presents; hence the phenomena of dislocations form a proper sequel to the study of the actions of muscles, more particularly as they are the opponents which resist our efforts to restore the bones to their natural position.

Dislocation of the thigh-bone is not by any means so frequent as that of the humerus. It may take place in either of four directions; the most frequent form of the accident is that in which the head of the bone is thrown upwards and backwards on the dorsum of the os ilii; the next is that in which it is thrown downwards and inwards on the foramen ovale; the third is that in which it passes backwards into the ischiatic notch; and the fourth where it rests upon the body of the os pubis. Were we to endeavour to determine the relative frequency of these displacements by *à priori* considerations founded on the structure of the joint, and not by appealing to the results of experience, or were it left to a mere anatomist to determine the question, he would be very likely to say that the dislocation into the foramen ovale must be more frequent than that upon the dorsum ilii, for the margin of the articular cavity at its upper and outer part is more prominent than at the lower and inner,—the capsular ligament is thick and strong in the former situation, and comparatively thin and weak in the latter; added to this, the movement of abduction may be carried to a very considerable extent, which will make the head of the bone glide downwards and inwards, where the least resistance is opposed to it; yet, of twenty cases, the results of which have been noticed in Guy's Hospital, twelve presented the first form of dislocation, five that into the foramen ovale, three that on the os pubis, and one into the ischiatic notch.

When the bone is thrown backwards upon the dorsum ilii, the state of the limb is as follows: it is rendered shorter than its fellow by about two inches, so that the great toe rests upon the tarsus of the other foot: the foot and the leg are turned inwards, and the knee somewhat advanced before the opposite one: the hip loses its roundness and fulness, the nates appearing somewhat flattened when compared with that of the sound side; and the trochanter major is thrown upwards so as to be brought nearer the anterior superior spinous process of the ilium; the foot cannot be turned outwards without causing much pain, but its inclination inwards may be increased. The limb will not admit of being abducted, but it may be drawn slightly across that of the other side. It is usually said that this accident may be confounded with fracture of the neck of the thigh-bone, but these accidents have but one circumstance in common, viz. the shortening of the limb. In the fracture just named,

the knee and foot are turned outwards; the thigh may be raised up somewhat towards the abdomen, although the attempt to effect this causes pain; and lastly, by a slight degree of extension, the length of the limb can be restored to its usual length, but it will become shortened again when the extension is discontinued.

When we refer to the reports of cases* of dislocation on the dorsum ilii, we find that this accident may occur under various circumstances. A man who worked as a labourer in a deep clay-pit "was in the act of stooping, with his left knee bent behind the other," when a large mass of clay fell upon him, so as to bury him in the earth. When removed from this position, the thigh-bone was found to be thrown upon the ilium. In another case, the displacement was occasioned "by a cart passing over the pelvis." A robust man "fell from a height of about four feet, and dislocated his hip." A carter, "in springing from the shaft of a waggon, slipped, and had his hip driven against the wheel with considerable force." The wheel of a cart "passed between a man's legs and over the upper part of the thigh, and produced dislocation on the dorsum ilii;" and the same accident occurred to a child, who, "whilst swinging on the shaft of a cart, which, being insecurely propped, suddenly gave way, and she fell to the ground upon her side." These different statements, taken from Sir A. Cooper's work on dislocations, merely make us acquainted with the circumstances under which the accident has occurred, and therefore might occur again, but do not furnish us with any adequate data from which we may infer how it is produced. It is not easy to perceive what they have in common, or why the same identical result should follow from accidents so various in their degree and character. Still, however vague and indeterminate they may be, they are of importance, inasmuch as they are taken from authentic reports of cases treated by competent persons. The following passage from Boyer† will show the risks which even the best-informed men incur of falling into error when they venture to decide upon subjects of this sort by *à priori* considerations. "When by a fall, from a place more or less elevated, on the soles of the feet or on the knees, the thigh is pushed forwards and inwards, the head of the femur, forced towards the superior and external part of the acetabulum, breaks the internal and orbicular ligaments, escapes through a laceration in the latter, and ascends on the external face of the os ilium; but as the part of the os ilium immediately above and at the external side of the cavity is very convex, the head of the femur soon abandons its first position, and slides backwards and upwards into the external fossa of the os ilium, following the inclination of the plane towards the fossa, and obeying the action of the glutei muscles, which draw it in this direction. The head of the femur, in ascending thus on the external face of the os ilium, pushes upwards the gluteus minimus, which forms a sort of cap for it; and the gluteus maximus and medius are relaxed by the approximation of the points into which they are inserted. The pyriformis is nearly in its natural state; the gemini, obturatores, and quadratus femoris, are a little elongated. The psoas magnus and iliacus internus are relaxed, as are also the other muscles inserted into the trochanter minor. If to this description it be added that the orbicular ligament, torn at its superior part, is stretched over the acetabulum and covers it, an exact idea may be formed of the changes occasioned in the surrounding parts by this luxation of the femur."

The statement here given in the words of M. Boyer, has evidently been drawn up, not from any case of dislocation which this distinguished surgeon had observed himself, or from any "post mortem" examination which he had ever conducted. We cannot find any case in which luxation of the thigh-bone backwards and upwards was produced by a fall on the soles of the feet or on the knees, yet from the passage above cited it would appear to be the most ordinary cause of the accident; and the condition of the muscles round the joint appears to be indicated from anatomical considerations, and not founded on observation. In the third volume of the Dublin Hospital Reports a case is detailed at considerable length by Mr. Todd, which places in a clear point of view the condition of the different textures about the hip-joint in this form of dislocation. The nature of the accident was ascertained soon after its occurrence, and the efforts to effect the reduction of the dislocation were successful; but the patient died from the injuries which he had previously sustained. When proceeding with the dissection, Mr. Todd found, "after he had raised the gluteus maximus, a cavity filled with coagulated blood between it and the posterior part of the gluteus medius;" this obviously marked the position which the head of the bone had occupied; the glutei muscles were uninjured, but "the rotators, together with the pyriformis, were torn across." Some fibres of the pectineus also were torn; the capsular ligament of the joint remained entire at its upper and fore part, but was torn in all the rest of its extent. The round ligament was broken off near the head of the

* A Treatise on Dislocations and Fractures, by Sir Astley Cooper, p. 41, et seq.

† Lectures on Diseases of the Bones, vol. ii. p. 158.

femur. Thus the condition of the muscles was found to be very different from that which Boyer had indicated. It is to be regretted that the report does not expressly say what was the state of the psoas and iliacus muscles: Boyer had inferred that they were relaxed as well as "the other muscles inserted into the trochanter minor," by which latter clause he doubtless alludes to the pectineus, which is inserted a little beneath it. But this muscle appears to have been stretched, so that "some of its fibres were even torn;" and such, we make no doubt, was the condition of the psoas and iliacus, both at the moment in which the head of the bone was sliding over the brim of the acetabulum, and even subsequently, when it rested upon the dorsum ilii: for the trochanter minor, though raised above its natural position, is carried so far back that the distance between the point of insertion of the muscles, and the brim of the pelvis over which they slide, is greater in the new position of the limb than in its natural state; in other words, these two muscles as well as the pectineus are in a state of tension, and to this is owing the position in which the injured limb is found, viz. that it is drawn forwards and inwards, and in advance of that of the opposite side. Moreover, the mode in which the extension is made by all surgeons has reference to the condition of the psoas and iliacus muscles, for the limb is drawn, at least when the extension is being commenced, in that direction which is most likely to relax them.

It has often been asked how it comes to pass that the foot and limb are turned inwards in this form of dislocation. Boyer inclines to the opinion, that it depends on the external portion of the capsular ligament, which comes from the anterior inferior spine of the ilium; this portion, which is very thick, being stretched in the luxation upwards, draws the great trochanter forwards, and thereby turns the entire limb inwards. He had previously laid down the general principle, that the position of limbs when luxated is always "determined by the elongation of the muscles of the side opposite to that to which the luxated bone is carried;"—for instance, in the luxation of the arm downwards into the axilla, the deltoid and supra-spinatus muscles, being stretched by the separation of their points of attachment, give the arm an oblique direction, and cause the elbow to project outwards from the side. If he had followed up this view of the case, he would have concluded that the trochanter

PLATE XXXVI.

Fig. 1. No. 1. The sacrum, divided along the middle line. 2. The coccyx. 3. The os pubis; the line of its symphysis. 4. Its ramus. 5. The tuberosity and ramus of the ischium. 6. The internal obturator muscle, as seen within the pelvis, from which it passes out through the small sacro-sciatic notch; its external portion is shown in several of the preceding plates; for instance, in plate XXXV. fig. 2, No. 6. 7. The origin of the pyriformis muscle from the anterior surface of the sacrum. 8. The gracilis muscle lying along the inner side of the thigh, and ending in a tendon, 9, which is prolonged to the tibia. 10. The semi-tendinosus muscle. 11. Its tendon. 12. The semi-membranosus muscle. 13. The biceps flexor cruris muscle. 14. Its tendon passing to its insertion into the head of the fibula. 15. The lower part of the sartorius muscle. 16. Part of the vastus internus muscle. 17. A small portion of the rectus femoris muscle. 18. The adductor magnus muscle, which is seen to be attached above to the tuberosity and ramus of the ischium. 19. A small part of the same muscle which is fixed higher up to the ramus of the os pubis. 20. A small portion of the adductor brevis muscle. 21. The upper part of the adductor longus muscle, where it descends from its attachment to the angle of the os pubis. 22. The patella. 23. The popliteal space, being the deep interstice between the flexor or ham-string muscles. 24. The upper part of the gastrocnemius muscle.

Fig 2. No. 1. The outer head or tuberosity of the tibia. 2. The upper head of the fibula. 3. The anterior tubercle of the tibia. 4. The lower extremity of the fibula, forming the external ankle. 5. The posterior part of the os calcis. 6. The fifth metatarsal bone. 7. The tibialis anticus muscle. 8. Its tendon passing down under the annular ligament. 9. Part of the tendon of the extensor proprius pollicis muscle, as seen in the interstice between the tibialis anticus and the common extensor muscle. 10. The tendon of the extensor pollicis, where it rests on the dorsum of the foot, after having passed under the anterior annular ligament. 11. The upper fleshy portion of the common extensor muscle of the toes. 12. Its tendon passing down to the ankle and under the annular ligament. 13, 13, 13, 13. The four tendons which are given off by the common tendon, and proceed over the foot to the four lesser toes. 14. The peroneus tertius muscle. 15. Its tendinous insertion into the fifth metatarsal bone. 16. The fleshy part of the peroneus longus muscle. 17. Its tendinous attachment to the head of the fibula. 18. Its tendon passing down behind the external ankle. 19. The same tendon, where it runs upon the outer side of the os calcis, and passes into the sole of the foot. 20, 20. The peroneus brevis muscle; the two references indicate that its fibres project on each side of the tendon of the peroneus longus. 21. The tendon of the peroneus brevis passing to its insertion into the posterior extremity of the fifth metatarsal bone. 22. The extensor brevis digitorum muscle. 23, 23, 23, 23. The four tendons which it gives off to the four inner toes. 24. The upper fleshy part of the gastrocnemius muscle. 25. The outer border of the soleus muscle. The fleshy fibres of this muscle and of the gastrocnemius are seen passing with various degrees of obliquity to be inserted into the tendo Achillis, 26; and this descends to be fixed to the posterior extremity of the os calcis.

Plate 36.

Fig. 1.

Fig. 2.

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Plate 37.

Fig 2

Fig 1

J. Walsh del et lithog.

was drawn forwards, at the moment in which the head of the bone is slipping over the brim of the acetabulum, by the contractile effort of the anterior fibres of the gluteus medius, which are then put on the stretch, and that they are aided in this by the tensor vaginæ femoris. But the influence of these two muscles he overlooked, and dwelt on the power of the short external rotators, which he supposed to remain entire, and still to possess their ordinary power over the limb, were they not controlled by some superior agency. His words are, "the obturatores, gemini, and quadratus femoris, being elongated, the point of the foot ought to be turned outwards:" but finding in all cases the reverse to be the fact, he comes to the conclusion that the power of the muscles is contravened by the ilio-femoral ligament. Sir Astley Cooper gives a different explanation of the position of the limb: he says it may be caused "by a fall when the knee and foot of the patient are turned inwards, or by a blow whilst the limb is in that position, and the head of the bone is thus displaced upwards and turned backwards." It is difficult to conceive how the head of the bone could quit its articular cavity whilst the limb is in the extended position, so as to be forced upwards, unless the brim of the acetabulum were at the same time broken. It may be forced backwards by a sudden and violent blow given to the posterior edge of the trochanter when a person is unprepared for any such occurrence; for, under these circumstances, the head of the bone is made to glide backwards to the posterior lip of the acetabulum, and to press so forcibly against the capsular ligament as to tear through it and escape from the articulation. We can readily perceive that this luxation may be produced by a force applied to the outer side of the knee when the limb is in the semi-flexed position, for then the head

PLATE XXXVII.

Fig. 1. The muscles of the leg are here shown as they are seen at its outer side when the skin and the fascia are removed.

No. 1. The patella. 2. The upper extremity of the tibia. 3. The external ankle, formed by the lower extremity of the fibula. 4. The posterior extremity of the fifth metatarsal bone. 5. The os calcis. 6. Part of the tendon of the rectus femoris muscle, where it descends to its insertion into the patella. 7. Part of the vastus externus muscle. 8. The biceps flexor muscle. 9. The upper extremity, or origin, of the long peroneus muscle. 10. The fleshy part of the same muscle. 11, 11. Its tendon passing down behind the external malleolus, and upon the outer side of the os calcis, from which it is prolonged into the sole of the foot, after having turned round its outer border. 12, 12. The fleshy part of the peroneus brevis muscle; its fibres are seen projecting beyond the tendon of the peroneus longus. 12.* The tendon of the peroneus brevis passing to its insertion into the fifth metatarsal bone. 13. The external head of the gastrocnemius muscle. 14. Its tendon,—tendo Achillis. 15. The lower part of the same tendon descending to its insertion into the os calcis. 16. The soleus muscle; its fibres are seen descending obliquely backwards to be inserted into the tendo Achillis. 17. The fleshy part of the tibialis anticus muscle. 18. Its tendon passing down towards the ankle. 19. The same tendon where it inclines towards the inner border of the foot: its position previously to its insertion is shown in fig. 2, No. 19. 20. The extensor communis digitorum muscle. 21. The tendon in which its fleshy fibres end. 22, 22, 22, 22. The digital processes into which this tendon divides, and which are prolonged over the dorsum of the foot to the four smaller toes. 23. The peroneus tertius muscle. 24. Its tendon at its insertion into the fifth metatarsal bone. 25. The tendon of the extensor muscle of the great toe (m. extensor pollicis longus), appearing in the interstice between the tendons of the tibialis anticus and extensor communis digitorum: from this point it will be observed to descend in front of the ankle-joint, and from thence over the dorsum of the foot to the great toe. 26. The extensor brevis digitorum muscle; on the dorsum of the foot.

Fig. 2. The muscles of the leg and foot, as seen at the inner side, after the skin and fascia have been removed.

No. 1. The patella. 2. The front of the tibia. 3. The anterior annular ligament of the ankle-joint. 4. The articulation of the base of the first metatarsal bone. 5. The os calcis. 6. The tendon of the rectus muscle, close to its insertion into the patella. 7. A few fibres of the vastus internus muscle. 8. The sartorius muscle, as it passes by the inner side of the knee-joint. 9. The expanded aponeurosis in which this muscle terminates previously to its insertion into the tibia, and which will be observed to conceal the tendons of the gracilis and semi-tendinosus muscles. 10. The tendon of the gracilis muscle. 11. Part of the semi-membranosus muscle. 12. The semi-tendinosus muscle. 13. The inner head of the gastrocnemius muscle. 14. The upper broad part of the tendo Achillis, in which the fibres of the gastrocnemius and of the soleus terminate. 15. The lower part of the tendo Achillis, near its insertion into the os calcis. 16. The inner edge of the soleus muscle; its fibres are seen inclining obliquely backwards as they descend to be inserted into the tendo Achillis. 17. A few fibres of the anterior edge of the tibialis anticus muscle. 18. Its tendon, as it descends obliquely inwards. 19. The same tendon turning to reach the inner border of the foot, beneath which it is inserted into the internal cuneiform and first metatarsal bone. 20. The tendon of the flexor communis digitorum muscle; 21. the tendon of the tibialis posticus muscle:—these are observed passing down behind the internal ankle in order to reach the sole of the foot. 22. Part of the tendon of the flexor longus pollicis, which in this view can be but slightly seen. 23. The origin of the abductor pollicis muscle. 24. The tendon in which its fleshy fibres terminate. 25, 25. Two of the tendons of the extensor communis digitorum muscle.

of the bone, sliding backwards and upwards in the acetabulum, is forced against the capsular ligament and ruptures it. In this state the rotators have little power, for the line of direction of most of them nearly coincides with that of the femur; and this is the position in which the anterior fibres of the gluteus medius and the tensor vaginæ can act upon the trochanter major, and draw it forwards, thereby placing the head of the bone in the position which it is known to assume in the dislocation on the dorsum ilii.

Dislocation into the foramen ovale.—The head of the thigh-bone is in some cases displaced in the opposite direction from that which we have above stated, and thrown downwards into the situation of the foramen ovale. Were we to judge solely from the anatomical conformation of the joint and the movements of the limb, we should be disposed to conclude that this displacement would occur more frequently than that on the dorsum of the ilium; for the capsular ligament is weaker at the lower and inner part of its extent than elsewhere, and the round ligament, by reason of its attachment to the margins of the cotyloid notch, does not check the descent of the bone towards the foramen ovale: Boyer goes so far as to say that the rupture of the round ligament is not a necessary consequence of this form of dislocation; upon which point, however, he is at issue with Sir Astley Cooper, who states that "the ligamentum teres, as well as the lower and inner part of the capsular ligament, is torn through:"—finally, this form of accident is in a manner facilitated by the great extent to which the thigh may be abducted. Notwithstanding all these circumstances, the dislocation on the dorsum of the ilium is found to be of more frequent occurrence. The head of the bone cannot be thrown downwards and inwards unless when the thigh is in a state of forcible abduction, a position in which the limb is placed in many accidents to which persons are liable. When this displacement occurs, the limb is found to be about two inches longer than the other, the trochanter major is less prominent, the knee is carried forwards and separated from the other, so as not to admit of being brought into contact with it, or approximated to the axis of the body without great difficulty. In the standing posture the body is bent forwards; the foot, though widely separated from the other, is stated by Sir Astley Cooper to be turned neither outwards nor inwards; in his plate it is figured as if the toe were directed forwards, but he does not consider that the direction of the foot affords any diagnostic mark of the accident, as he found it to vary somewhat in different instances. The increased length of the limb, the separated knees, the bent position of the body, all point to the nature of the accident; and if at the same time a hollow is perceived beneath Poupart's ligament, and the head of the bone be felt a little before and beneath the axis of the acetabulum, no doubt will remain as to the form of the dislocation. In a case of this sort, which Sir Astley Cooper had an opportunity of examining after death, he found the head of the thigh-bone lodged in the foramen ovale, the obturator externus muscle being entirely absorbed. The accident was evidently one of long standing, as the foramen ovale was filled up by bone, and osseous matter was deposited round its margin, so as to form a new socket for the head of the femur. The original acetabulum was nearly filled up with bony matter, the round ligament was torn through, and also the capsular ligament in part of its extent; the pectinalis muscle and the adductor brevis had been lacerated, but were united by tendinous fibres; the psoas and iliacus muscles, the glutei and the pyriformis, were all stretched. Sir Astley does not, however, say in what condition he found the gemelli and obturator internus muscles, or the quadratus femoris; but if the pyriformis is stretched, these must be much more so, and most likely are torn across at the moment that this accident occurs; and as the adductor brevis was found to have been torn, it is sufficiently obvious that the adductor longus and magnus must be elongated and stretched, in which condition they can readily be felt along the inner side of the thigh, forming a tense margin. This condition of the muscles necessarily tends to evert the toes, the only countervailing agent being the tensor vaginæ femoris, and perhaps a few fibres of the gluteus medius; hence, though in the general summary of the symptoms Sir Astley Cooper states that the toes are neither turned inwards nor outwards, in the first case, the history of which he details, page 60, "the toes were rather everted," and in the second case, page 62, "the foot was rather inclined outwards." When this dislocation remains unreduced, the limb is too long, and occasions a halt and a lameness, so that in progression the elongated extremity would be made to describe a curve outwards at each step which is taken.

In recent cases, the reduction of this dislocation is in general easily effected. Sir Astley Cooper directs the patient to be placed upon his back with his thighs separated as widely as possible; that a girth be passed round the flexure of the luxated thigh, and fixed to a staple in the wall or in the bedpost; the surgeon then takes hold of the ankle of the dislocated side, and draws it steadily inwards in front of the sound limb, by which means the head of the bone will be dislodged from its new position and forced backwards towards the acetabulum, into which it will pass with a jerk or snap, caused

by the action of the muscles which were put on the stretch during the unnatural position of the limb. Whenever the dislocation has remained unreduced for two or three weeks, it is found necessary to place the patient in a different position in order to effect the reduction. He should be placed upon the sound side. The pelvis is then fixed by a bandage carried round it, and counter-extension is to be effected by a girth carried round the dislocated thigh, and fixed to a pulley suspended over the patient. Extension is then made by drawing the dislocated thigh directly upwards, the knee and the foot being pressed down so as to prevent the lower part of the limb from being elevated with the thigh-bone. In this way the thigh is made a lever of considerable force, by means of which the efforts of extension are directed upon the muscles which oppose the reduction, so as to overcome their resistance.

Dislocation backward into the ischiatic notch.—When the head of the femur is thrown backwards out of the acetabulum, it rests upon the pyriformis muscle, and occupies the interval between the small sacro-sciatic ligament and the margin of the ischiatic notch. This accident may be either primary or secondary; that is, it may be the direct and immediate result of force or violence so applied to the limb as to throw the bone from its articular cavity into the position here indicated, or it may follow and be a consequence of another mode of dislocation; not, however, in the manner in which Boyer* states it, for he seems to think that the head of the femur, in a case of luxation upwards and outwards, may slide from the position which it at first occupies upon the external surface of the ilium downwards and backwards into the ischiatic notch, its passage in this direction being favoured by the bending of the thigh upon the pelvis. This mode of explaining the occurrence proceeds on the assumption that a second disturbing force is applied to the limb immediately after the dislocation on the dorsum ilii had occurred, somewhat in the same way as dislocation of the os humeri forwards under the pectoral muscle is made to supervene upon a primary displacement of the bone downwards into the axilla. It very seldom, if ever, happens that a second injury follows so quickly upon the first as to produce a secondary displacement of the femur in this way; but it may readily occur during the effort to reduce a primary dislocation upon the dorsum ilii, if the extension of the limb be discontinued before the head of the bone is drawn downwards to a level with the acetabulum; for if it be let go too soon, the muscles will draw it directly backwards into the ischiatic notch: this I have known to occur in one instance, and the secondary luxation was never reduced. It may also occur as a consequence of dislocation into the foramen ovale; for if the thigh is large and fleshy, it must necessarily incline somewhat forward during the effort to effect its reduction by drawing it across the sound limb, and so some risk is incurred of tilting the head of the bone backwards beneath the acetabulum into the ischiatic notch. To prevent the possibility of such an occurrence, Mr. Key, in a case, the particulars of which he transmitted to Sir Astley Cooper, (on Dislocations, p. 67,) "thought it advisable to carry the leg behind the sound one."

In the dislocation now under notice the limb is somewhat shortened, usually however not more than half an inch or an inch. The great toe rests against the inner side of that of the other foot; the knee and the foot are slightly turned inwards, the inclination in that direction being less than in the dislocation on the dorsum ilii; neither is the knee so much in advance of the sound limb as in the last-named accident. When the patient is in the standing posture, the toe, but not the heel, will touch the ground. On feeling for the trochanter major, it will be found behind its usual position, and having a very slight inclination towards the acetabulum; but the head of the bone is sunk so deeply into the ischiatic notch that it can scarcely be felt except in very thin persons.

Boyer appears to have formed his opinion as to the condition of the limb in this accident from merely anatomical considerations, and not from observation of cases which presented themselves to his notice. He says that when this luxation is primary, the limb is lengthened, the great trochanter by descending is removed farther from the spine of the ilium, and that the knee and foot are turned "outwards;" but if it be secondary, the knee and foot are turned "inwards." Sir Astley Cooper observes, that this error as to the state of the limb runs through the writings of every author who has treated of the subject, and he proceeds to point out the mistakes in practice to which such a description may give rise when it is unreservedly adopted. A gentleman wrote to him from the country to say that he had under his care a case of injury of the hip, which he would suppose to be a dislocation into the ischiatic notch, but that the limb was "shorter instead of being longer, as authors state it to be."

The circumstances under which this dislocation occurs are various. Thus, one person, whilst

* Lectures on Diseases of the Bones, vol. ii. p. 167.

carrying a bag of sand, " stepped unexpectedly into a hollow in the road on which he walked, when his knee was turned inwards, at the same time that his body fell forwards with some violence." Another person, a sailor, rested his foot upon a chest raised a little way from the ground, when a box or basket fell upon his thigh, " striking the knee inwards." He fell; and when brought for examination, it was found that the head of the thigh-bone was thrown backwards into the ischiatic notch. In this latter case, the knee appears to have been pressed inwards whilst the thigh was placed at right angles with the abdomen; this position of the limb appears to be necessary to the production of the accident.

The reduction of this dislocation is confessed by all persons to be difficult, in consequence of the peculiar situation of the head of the bone with regard to the acetabulum; for it must be drawn towards the articular cavity, and also lifted over its margin. The patient is to be laid upon a table, resting on the sound side, and a girth placed between the pudendum and the inner part of the thigh, so as to fix the pelvis, and this is attached to a ring fixed behind the line of direction of the body; a wetted roller and strap should then be applied above the knee; to this a pulley is attached, which is fixed before the line of the body. The adjustment being thus made, the dislocated femur is drawn obliquely downwards across the other thigh; and whilst the extension is steadily kept up, an assistant passes a napkin under the upper part of the thigh, with which he lifts the bone as it is drawn towards the acetabulum over its brim. It is also found necessary to rotate the limb inwards, in order to facilitate the passage of the head of the bone over the margin of the articular cavity. As to the condition of the parts around the articulation, we are informed by Sir Astley Cooper that, in a case which he met with accidentally in the dissecting-room, and in which the luxation was not reduced, the original acetabulum was filled with a ligamentous substance; the capsular ligament was torn at its anterior and posterior part, but not at the superior and inferior; the round ligament was broken across, a part of it still remaining adherent to the head of the bone; the head of the femur, placed behind the acetabulum, rested upon the pyriformis, which muscle was diminished, but still there was no bony socket formed for the head of the bone: a new capsular ligament, however, was established, apparently consisting of condensed cellular membrane. It is to be regretted that all mention of the state of the muscles has been omitted in this report, more particularly as Boyer appears to have indicated their condition from anatomical or *à priori* views. He tells us that the muscles which cover the posterior part of the acetabulum, such as the pyriformis, gemelli, obturatores, and quadratus femoris, are raised up and stretched; and that the psoas magnus and iliacus are in a great state of tension, which explains the turning of the limb " outwards." In all the cases of which we have detailed statements, the foot is stated to have been turned " inwards;" and as to the condition of the rotator muscles, they are much more likely to be torn than merely " raised up and stretched."

PLATE XXXVIII.

Fig. 1. The superficial muscles of the calf of the leg are here shown as they are viewed from behind.

No. 1. The lower part of the thigh-bone. 2. Its inner condyle. 3. The outer condyle. 4, 4. The two heads of the gastrocnemius muscle. 5, 5. The broad fleshy part of the same muscle, where it forms the thick part of the calf of the leg. 6. The tendo Achillis, in which the fibres of the gastrocnemius muscle are inserted, and which is prolonged downwards to the os calcis. 7, 7. Some of the lower fibres of the soleus muscle, projecting on each side of the preceding muscle, and descending with an inclination backwards to be inserted into the anterior surface of the tendo Achillis. 8. The tendon of the tibialis posticus muscle, where it passes behind the inner ankle. 9. The tendon of the flexor communis digitorum muscle. 10. The tendon of the flexor pollicis longus muscle. 11. The peroneus longus muscle; its posterior border. 12. Its tendon passing behind the external ankle. 13. Part of the peroneus brevis muscle. 14. Its tendon. 15. Part of the fibrous band which binds down these tendons. 16. The cellular and adipose substance which forms the cushion of the heel, cut through. 17. The tegument covering the inner border of the foot. 18. The tegument at the outer border of the foot.

Fig. 2. No. 1. The lower part of the thigh-bone. 2. Its inner condyle. 3. The outer condyle. 4. The fleshy part of the plantaris muscle. 5. Its long thin tendon. 6. Part of the popliteus muscle. 7, 7. The broad fleshy portion of the soleus muscle. 8. The upper part of the tendo Achillis; this tendon will be observed to be cut across at its point of junction with the gastrocnemius, which muscle is altogether removed, in order to bring the soleus and plantaris into view. 9. The os calcis, giving insertion to the tendo Achillis. 10. The tendon of the tibialis posticus muscle. 11. The flexor communis digitorum muscle. 12. The tendon of the flexor longus pollicis muscle. 13. The posterior edge of the peroneus longus muscle. 14. Its tendon descending behind the external ankle. 15. Part of the peroneus brevis muscle. 16. Its tendon. 17. A few fibres of the flexor longus pollicis muscle. 18. The subcutaneous cellular and adipose substance which was cut through while making the dissection.

Plate 38.

Fig. 1.

Fig. 2.

William Fairland lith.

J. Walsh del.

London, John Taylor, Upper Gower St.

Printed by Graf & Soret.

Plate 39.

Fig 1.

Fig 2.

J. Walsh del et lithog

Printed by C. Hullmandel.

John Taylor, Upper Gower Street.

Dislocation forwards on the pubes.—The head of the thigh-bone may be protruded from the acetabulum, and made to pass forwards towards the pubes, so as to rest upon the brim of the pelvis. When this has happened, the dislocated limb becomes shorter than the other by about an inch; the knee and foot are turned outwards, and cannot be rotated inwards; the great trochanter is approximated somewhat to the anterior superior spinous process of the ilium, and lies a little before it; the head of the bone, like a hard round ball, can be distinctly perceived to project above the level of Poupart's ligament, supported on the brim of the pelvis, lying to the outer side of the femoral vessels. Though this accident appears easy of detection, Sir A. Cooper met with three instances in which it was altogether overlooked, until it was too late to admit of being reduced. In a case of this kind, which was dissected after death, the capsular ligament was found to be extensively lacerated, and the round ligament broken through; the head of the thigh-bone had raised up Poupart's ligament, having slipped between it and the os pubis. In this position the tendon of the psoas and iliacus muscles was raised up and passed over the neck of the bone as they descended to their insertion. The crural nerve, lying between the iliacus and psoas, passed in front of the neck of the bone. The original acetabulum had become partly filled up by osseous deposit, and was greatly altered in form; so was the trochanter major, which lay upon it. A new articular cavity was formed upon the os pubis, which supported the neck of the bone, for its head projected above the brim of the pelvis. Poupart's ligament lay before the head of the bone; the femoral vessels to its inner side, and the anterior and inferior spinous process to its outer side.

This accident occurs in various ways. Sir A. Cooper gives the report of a case communicated to him by Mr. Tyrrell, in which this dislocation was produced by violence applied directly to the part. "A man, whilst standing at the corner of a street, was struck on the back part of the right hip by a cart-wheel, and knocked down by the blow." In this instance the head of the bone could be distinctly felt under Poupart's ligament, immediately to the outside of the femoral vessels. The limb was turned outwards, but was very little altered in its length; it could be rotated outwards, but not at all inwards, the thigh admitting only of a partial abduction and adduction. In a case which presented itself to Desault, the accident occurred in a very different way: the subject of it was a porter in one of the markets. This man's foot happened to slip whilst a heavy burden was being placed upon his shoulder: his leg and thigh were carried backwards, his body also became inclined a little backwards; and in the struggle to recover the erect position, the head of the femur was thrust forwards and upwards, so as to tear through its capsular ligament, and pass forwards into the fold of the groin, where it was distinctly perceptible.

PLATE XXXIX.

The deep-seated muscles of the leg are shown in these drawings. In order to expose them, the gastrocnemius, the soleus, and the plantaris have been removed, and also the deep fascia which is interposed between the superficial and deep-seated muscles.

Fig. 1. No. 1. The lower extremity of the thigh-bone—its posterior surface, where it corresponds with the popliteal space. 2. The inner condyle. 3. The tendinous part of the popliteus muscle. 4. The fleshy part of the same muscle. 5. The head of the fibula. 6. Part of the tibialis posticus muscle, corresponding with the interval between the tibia and fibula. This muscle extends higher up than the common flexor of the toes and the flexor of the great toe, between which it is seen at its upper part; lower down it is overlapped by them and concealed. 7. The tendon of the tibialis posticus muscle, where it passes behind the inner ankle, and proceeds towards the sole of the foot. 8. The common flexor muscle of the toes (m. flexor communis digitorum). 9. Its tendon, where it passes behind the inner ankle, resting upon and partly concealing the tendon of the tibialis posticus. 10. The long flexor of the great toe (m. flexor longus pollicis). 11. Its tendon, where it passes behind the tibia to reach the sole of the foot. 12. The long peroneal muscle (m. peroneus longus). 13. Its tendon. 14. The short peroneal muscle (m. peroneus brevis). 15. Its tendon. 16. Part of the inner ankle. 17. The posterior surface of the os calcis. 18. The metatarsal bone of the great toe. 19, 20, 21, 22. The metatarsal bones of the small toes. 23, 23, 23, 23. The four tendons derived from the long flexor muscle proceeding to the small toes. 24. The tendon of the long flexor muscle of the great toe. 25. The tendon of the peroneus longus muscle, where it turns into the sole of the foot.

Fig. 2. No. 1. The posterior surface of the head of the tibia. 2. The head of the fibula. 3. The tibialis posticus muscle: its fibres are seen arising from the tibia and fibula, and passing obliquely to be fixed into the tendon which lies along its posterior aspect. 4. The tendon of the tibialis posticus muscle passing behind the inner ankle. 5. Part of the inner ankle. 6. Part of the external ankle. 7. The posterior surface of the os calcis. 8, 9, 10, 11, 12. The metatarsal bones of the toes. 13. The fleshy part of the long peroneal muscle (m. peroneus longus). 14. Its tendon passing down behind the outer ankle. 15. The fleshy fibres of the short peroneal muscle (m. peroneus brevis). 16. The tendon of the same muscle proceeding to its insertion into the base of the fifth metatarsal bone.

When proceeding to effect the reduction of this dislocation, the patient is placed on a table, resting on the sound side, and a girth is passed between the pudendum and inner part of the thigh, and fixed to a staple placed a little before the line of the body; a roller and strap are then bound a little above the knee, in the usual way, to which a pulley is attached, in order to make extension. The traction should be made in such a way that the thigh-bone is drawn in the direction of a line a little behind that of the axis of the body. When extension is kept up for a short time, another bandage is to be applied around the upper part of the thigh, close to the perinæum, by means of which the head of the bone is raised. In this manner the reduction is accomplished without much difficulty in recent cases.

What, it will be asked, is the relative frequency of these different modes of dislocation of the thigh-bone? Sir A. Cooper gives, as the result of his extensive observation, the proportion in this way: out of twenty cases, he found twelve on the dorsum ilii, five in the ischiatic notch, two in the foramen ovale, one on the pubes.

PLATE XXXII.

The muscles placed at the fore part of the thigh are exhibited in these drawings; the skin, the fascia, and the vessels being all removed.

The Tensor muscle.—At the upper and outer part of the limb a short muscle is seen, marked 5, 6, extending obliquely downwards from the point of the hip, and terminating a little below the prominence (trochanter major) of the thigh bone. This is the tensor muscle of the fascia of the thigh (m. tensor vaginæ femoris). It is compressed and flat in the greater part of its extent, narrow at its upper extremity, but becomes wider towards the lower. It arises from the anterior superior spinous process of the ilium, where it is fixed to the outer surface of the bone by tendinous fibres; to these the muscular fibres succeed, and spread out somewhat as they run downwards, and terminate by becoming inserted between two layers of the fascia lata of the thigh, which in a manner embrace them. The inner or anterior edge of the muscle is observed to be in apposition for a while with the sartorius muscle (No. 8), but lower down an interval is left between them by their divergence, in which the rectus, No. 10, (which at its upper part is concealed by them,) comes forward into view.

The Sartorius muscle.—Along the anterior and inner aspect of the limb a lengthened strap-like muscle is seen to lie extended from the most prominent point of the hip, downwards and inwards, across the muscles of the thigh; then changing its direction, so as to descend by the inner side of the knee-joint, to terminate at the inner and upper part of the tibia. It is marked 8, 9, and is called the sartorius or tailor's muscle. It is fixed at its upper extremity, by tendinous fibres, to the anterior superior spinous process of the ilium, and to the curved margin of the bone beneath it: the fleshy fibres, which soon succeed to those that are white and tendinous, form a flat strap, about an inch or an inch and a quarter in width, which rests on the psoas and iliacus muscles, 17; on the pectineus, 18; and on the adductor longus, 19. Its outer side rests on the rectus femoris, 10; and on the vastus internus, 16. Beside the knee, it overlays the internal lateral ligament of the joint, and the tendons of the gracilis and semi-tendinosus muscles. Towards its lower part this muscle expands into a broad aponeurosis, which, after covering the tendons just named, becomes fixed to the upper and inner side of the tibia a little below its tuberosity.

The Rectus muscle.—Along the front of the thigh is stretched a muscle, which is broad and fleshy towards its middle, but narrow and tendinous at its extremity. It is marked 10, 11, and named the straight muscle of the thigh (m. rectus femoris). It is extended in a straight line downwards from the pelvis to the knee-pan, or patella. The middle fleshy portion, constituting the body of the muscle, swells out towards its central part, and tapers towards its extremities. The muscular fibres are arranged in two sets, one at each side; for they pass off obliquely towards the edges of the muscle, somewhat as the fibrillæ of a quill or feather do: muscles so constructed are said to be penniform. The muscular fibres at their lower end are seen to terminate in a tendon, 11, the fibres of which become fixed to the upper end and anterior surface of the patella; but they do not terminate upon this bone: they are found to be prolonged below its lower margin, where they constitute the ligament of the patella, 13, which is finally fixed into the tubercle in front of the tibia. In this way the straight muscle is made to act upon the tibia, and bring it (if it has been previously bent) into a direct line with the thigh-bone. The upper end of the straight muscle is concealed by the sartorius, 8, and the tensor, 5; it is tendinous in its structure, and is fixed by means of two processes, of which one is

attached to the anterior inferior spinous process of the ilium, (fig. 2, No. 2,) whilst the other is reflected outwards, and is attached to the margin of the articular cavity of the thigh-bone.

The Vastus Externus muscle.—At the outer side of the thigh is a large and long muscle, which from its length and bulk is called vastus externus, 15. (It is shown also in plate XXXV. fig. 1, No. 19; also in fig. 2, Nos. 10, 10.) It extends from the great trochanter of the thigh-bone downwards to the lower tendon of the rectus muscle, and the base of the patella, and forms the fleshy mass placed along the outer side of the thigh. The fibres of this muscle are observed to be attached as high up as the root of the great trochanter, from which point down as far as the middle of the oblique line leading to the outer condyle of the femur, the muscle takes points of attachment along the whole length of the linea aspera, as well as from the external surface of the bone. Hence the direction of the fibres varies considerably; some of them descend straight downwards, others become somewhat oblique, whilst those at its lower margin pass forwards, becoming almost transverse; and these latter are necessarily much shorter than those above them. The muscle becomes inserted at its lower extremity into the tendon of the rectus muscle, and into the base of the patella. There is a considerable mixture of tendinous fibre in this muscle, particularly at its upper part.

The Vastus Internus muscle.—Along the inner side of the thigh, a muscle somewhat similar to the preceding is placed, which, though not so large, still deserves the name of vastus internus; it is numbered 16: part only of it is seen in this drawing, the rest being concealed by the sartorius. It extends from a little below the small trochanter of the femur, (fig. 2, No. 9,) as far as to the base of the patella: its fibres are attached along the inner side of the thigh-bone and the margin of the linea aspera, as well as to part of the oblique ridge which leads from the latter to the inner condyle. The lower fibres are oblique in their direction, as they incline outwards and downwards to reach their insertion into the edge of the tendon of the rectus muscle and the base of the patella; there is a considerable admixture of tendinous fibres, particularly at its points of attachment.

The Crureus muscle.—In the interval between the two vasti above described, a muscle called crureus is placed, which is connected with them so intimately, that all three may be said to form one; and some persons have considered them in this way, as a single muscle made up of three parts or heads, and as such deserving the name of triceps femoris. The crureus taken by itself, and considered as a single muscle, extends the length of the body of the thigh-bone, as it reaches from the oblique line between the trochanters down to the patella; its fibres take points of attachment along the anterior surface of the femur, and are blended on each side of the vasti: it is concealed by the rectus, which lies in front of it.

Actions.—The name given to these muscles (extensors) at once indicates their most usual action, which is that of straightening the leg upon the thigh; and this they are enabled to do by reason of their connexion with the patella, for the ligament of this bone being fixed to the tibia, the whole force of the muscles is directed to the latter bone; they are the direct antagonists of the flexor muscles, and are called into play whenever any circumstance tends to bend the knees. Thus, in walking down a hill, they must make almost constant efforts to keep the limbs sufficiently straight for the performance of the required movements; which accounts for the sense of weariness so frequently induced when their action is too long continued. These muscles, like most others, can reverse their line of action so as to direct their force upon the thigh-bone and the pelvis. When the leg is fixed, as in the standing posture, and the tibia gives them their point of support, the two vasti will then draw upon the femur, and keep it erect upon the leg; and the rectus can also pull upon its upper points of attachment, and combine with the adductors, the psoas, and others, in keeping the pelvis steady upon the thigh. The power of the sartorius over the leg cannot be much; it may bend it upon the thigh, and perhaps incline the knee a little outwards; its power can be more effectually exerted in maintaining the pelvis erect upon the thigh; for by taking its fixed point of attachment at the tibia, it is enabled to act upon the spine of the ilium, and assist other muscles in drawing the pelvis forwards, making it to rest steadily upon the thigh-bone.

Fig. 2. When the superficial muscles above noticed, viz. the tensor vaginæ, the sartorius, the rectus, and the vasti, have been removed, another group is brought into view, consisting of the adductor muscles, with two of the external rotators, viz. the obturator externus, 17; and quadratus femoris, 18. The adductor muscles are placed along the inner side of the thigh, extending obliquely from the pelvis to the femur; they are three in number, and differ in form and size; they are named the adductor longus, 14; the adductor brevis, 13; and the adductor magnus, 15, 15. With these we may associate another, which combines with them in their action, the general direction of its fibres being somewhat the same; it is named pectineus, and is shown partly in fig. 1, No. 18.

The Pectineus muscle, fig. 1, No. 18, is placed obliquely at the upper and fore part of the thigh, being extended from the upper surface of the pubic bone, downwards and outwards, to reach the thigh-bone a little below the small trochanter. It is flat and compressed; and consists of tendinous fibres at its attachments, the rest of it being fleshy.

The long Adductor muscle (m. adductor longus), fig. 2, No. 14, is placed in an oblique position at the inner part of the thigh, being extended from the angle of the pubic bone to about the middle of the femur. It is compressed and flat in the greater part of its extent, and irregularly triangular in its form; its

PLATE XL.

Fig. 1. The first layer of muscles in the sole of the foot is here brought into view by the removal of the skin and the plantar fascia. One of these muscles lies along the inner border of the foot, and is named the abductor of the great toe; it is marked by the figures 2, 3, 4: another occupies the middle of the foot, and is named the short flexor of the toes; it is marked 5, 6: the third muscle is the abductor of the little toe; it is marked 9, 10, 11.

No. 1. The under surface of the os calcis. 2. The fleshy part of the abductor muscle of the great toe (m. abductor pollicis pedis). 3. The tendon of the same muscle. 4. Its insertion into the inner border of the first phalanx of the great toe at its base. 5. The short flexor muscle of the small toes, arising from the under surface of the os calcis. 6. The anterior extremity of the muscle dividing into four processes, from each of which a tendon proceeds to the toes. 7, 7, 7, 7. The tendons of the short flexor muscle, proceeding beneath the toes, and dividing so as to leave a fissure, through which the tendons of the long flexor muscle pass: hence it is called flexor perforatus. 8, 8, 8, 8. The tendons of the short flexor muscle at their points of insertion into the bases of the second phalanges of the toes. 9. The abductor of the little toe (m. abductor digiti minimi). 10. Its tendon. 11. Its insertion into the base of the first phalanx of the little toe. 12. Part of the short flexor of the little toe. 13, 13, 13, 13. The four lumbricales muscles. 14, 14. The inner and outer heads of the short flexor of the great toe (m. flexor brevis pollicis pedis). 15. The tendon of the long flexor muscle of the great toe. 16. Its insertion. 17, 17, 17, 17. The tendons of the common flexor muscle of the toes, passing through slits in the tendons of the flexor brevis, and proceeding to their insertions into the last digital bones, which are marked 18, 18, 18, 18.

Fig. 2. The muscles which form the second plane in the sole of the foot are here brought into view by the removal of those which are shown in the preceding figure.

No. 1. The under surface of the os calcis. 2. The posterior extremity of the fifth metatarsal bone. 3. A part of the abductor pollicis muscle left attached by its tendon, its fleshy portion being cut away. 4, 4. The inner and outer heads of the flexor brevis pollicis muscle. 5. The tendon of the long flexor muscle of the great toe, where it passes into the sole of the foot; it is seen crossing the tendon of the common flexor muscle. 6. The continuation of the tendon of the long flexor muscle, passing between the two heads of the short flexor, and proceeding to its insertion into the great toe. 7. The tendon of the common flexor muscle passing obliquely along the hollow of the foot. 8. The tendon of the same muscle, at the point where it divides into four processes (9, 9, 9, 9), which proceed along the under surface of the toes, and are inserted into their last phalanges (10, 10, 10, 10). 11, 11, 11, 11. The four lumbricales muscles. 12. The two pointed processes by which the accessory muscle arises (m. accessorius ad flexorem communem). 13. The body or fleshy part of the accessory muscle, where it becomes attached to the tendon of the common flexor. 14. The short flexor muscle of the little toe. 15. The third plantar interosseous muscle. 16. Part of the fourth dorsal interosseous muscle, which here dips into the sole of the foot.

Fig. 3. The muscles which form the third or deepest layer in the sole of the foot are here seen, those in the second having been removed in order to bring them into view.

No. 1. The under surface of the os calcis. 2. The posterior extremity of the fifth metatarsal bone. 3, 4. The tubercles at the under surface of the os calcis. 5. The long plantar ligament. 6. The abductor muscle of the great toe (m. abductor pollicis pedis). 7, 7. The two sesamoid bones, with which the muscles are connected previously to their insertion. 8. The adductor pollicis pedis, which becomes connected with the outer head of the short flexor muscle previously to its insertion. 9. The short flexor muscle of the little toe. 10. Its point of attachment to the base of the fifth metatarsal bone. 11. Its insertion into the outer border of the first phalanx of the little toe at its base. 12. The transverse muscle of the foot (m. transversus pedis). 13, 13, 13. The three plantar interossei muscles.

Fig. 4. The upper surface or dorsum of the foot is here shown, with the short extensor muscle of the toes resting upon it.

No. 1. The os calcis. 2. The upper surface of the astragalus. 3. The posterior part or origin of the short extensor muscle of the toes (m. extensor brevis digitorum pedis). 4, 4, 4, 4. The pointed processes into which it divides; each of these ends in a tendon which is prolonged to the dorsal surface of the toes. 5. The insertion of the first tendon into the dorsal surface of the great toe. 6, 6, 6. The tendons of the other processes joining with those of the long extensor muscle. 7. A part of the tendon of the long extensor of the great toe. 8, 8, 8. The tendons of the common extensor muscle resting on the dorsal surface of the four small toes. 9. Part of the abductor of the little toe. 10. Part of the first dorsal interosseous muscle. 11. The second dorsal interosseous muscle. 12. The third dorsal interosseous muscle. 13. The fourth dorsal interosseous muscle.

Plate 40.

Fig: 1.

Fig: 2.

Fig: 4

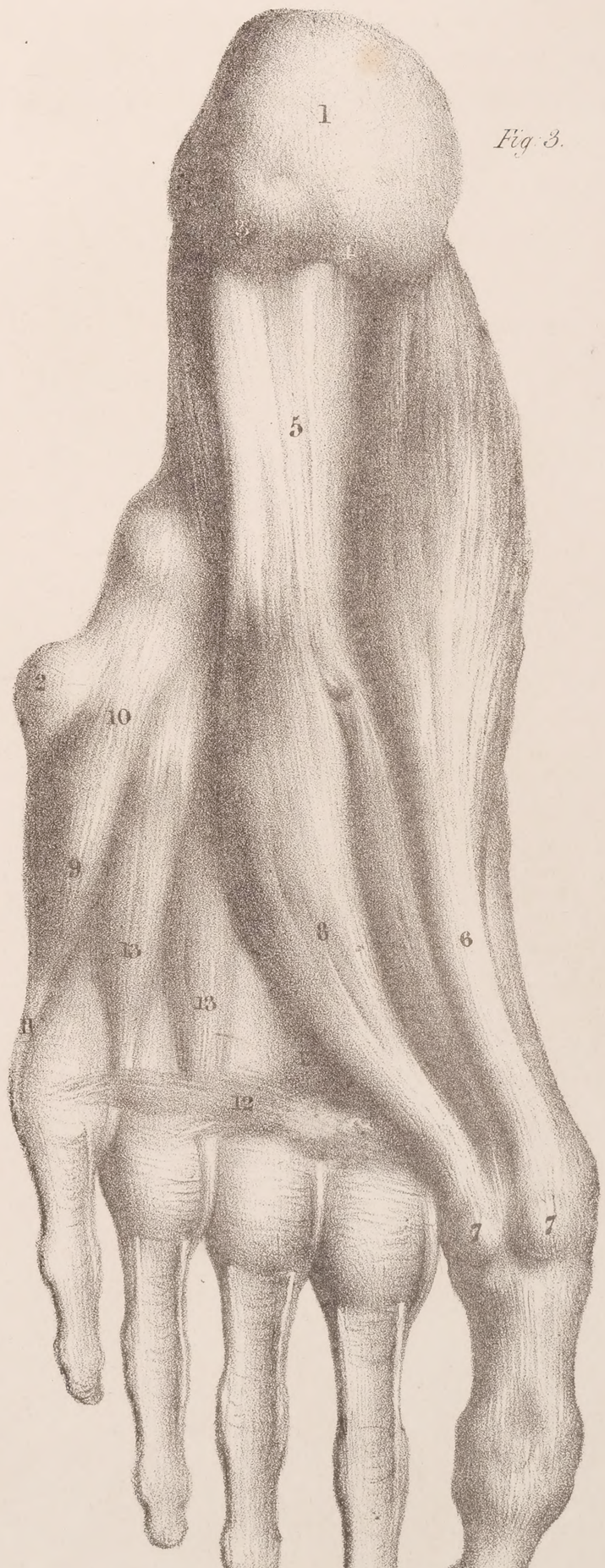
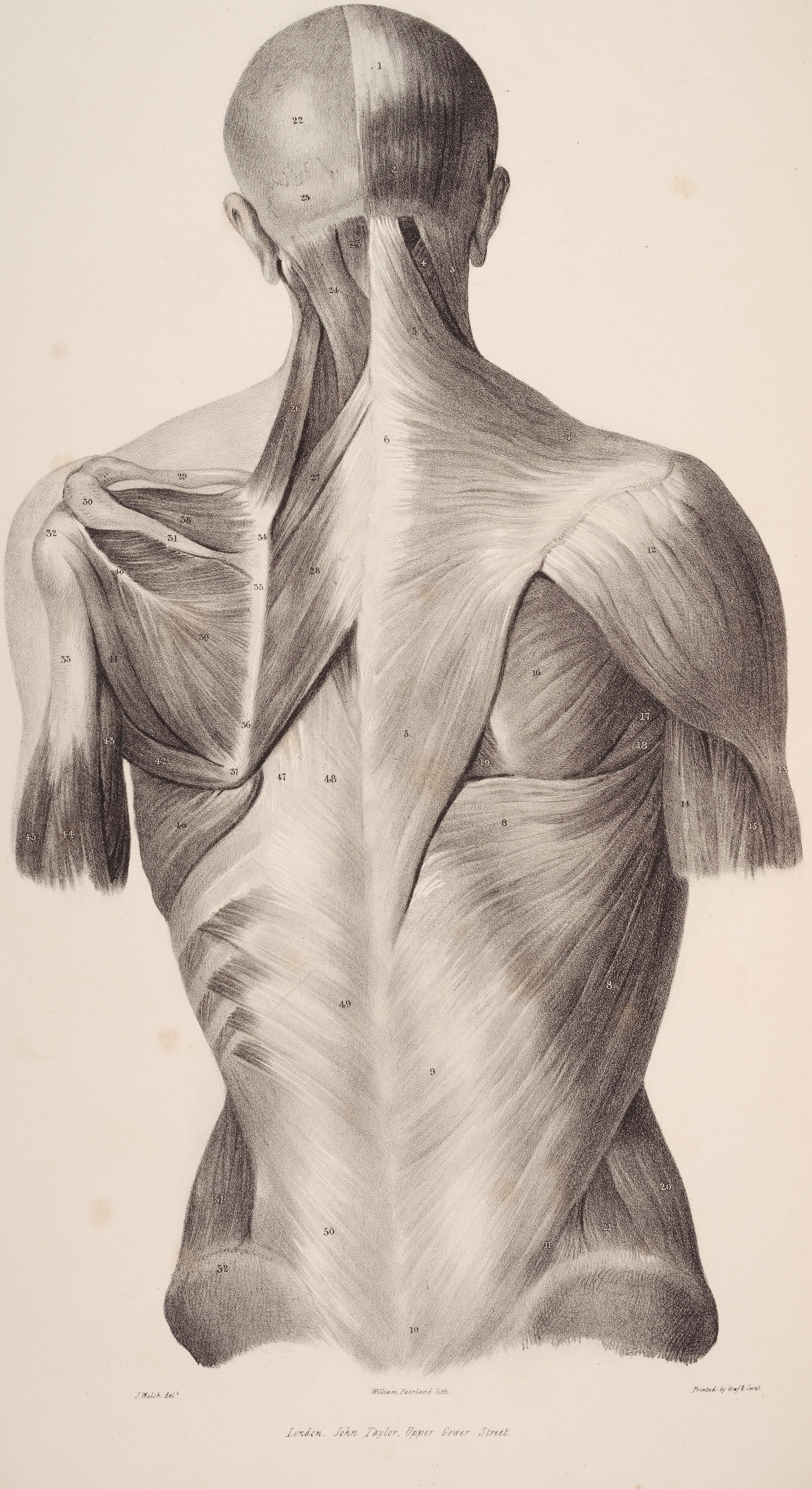


Fig: 3.

Plate 41.



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middle part or body is fleshy, and the extremities tendinous. This muscle is narrrow at its upper end, and is there fixed by tendinous fibres to the angle of the os pubis; its fibres spread out somewhat as they descend, and become inserted into the middle third of the rough line at the back of the thigh-bone.

The short Adductor muscle (m. adductor brevis,—secundus) is shorter than the preceding muscle, and lies higher up; it is overlaid at its origin, and also in some degree lower down, by the adductor longus. The form of the muscle is irregularly triangular: it is narrow at its upper end, where it is fixed by fleshy and tendinous fibres to the surface of the pubic bone, but widens gradually as it descends to its insertion, which takes place at the upper part of the linea aspera, and the oblique line which leads from it to the small trochanter.

The great Adductor muscle (m. adductor magnus). A flat plane of muscular fibres is shown here to lie behind and support the long and the short adductor muscles; part of it is observed to project above them, and a considerable part below them, marked 15, 15; and the lower portion is moreover observed to be prolonged to the inner condyle of the femur, the prolonged part being marked 16. The muscle is of very considerable extent, as it reaches nearly the whole length of the shaft of the thigh-bone, and may be likened to a flat plane of fleshy fibres, interposed between the muscles which lie in front of the thigh, and the long flexors which are placed behind it. Its form is obviously triangular; its base being represented by its line of insertion into the thigh-bone, whilst the apex corresponds with its origin or point of attachment to the ischium. Between the broad part of this muscle, which is inserted into the linea aspera of the thigh-bone, and the prolonged slip, 16, which goes down to the inner condyle, an aperture exists for the transmission of the femoral vessels as they pass backwards to reach the posterior aspect of the limb.

Actions.—These muscles are of considerable power. It is obvious, from their line of direction, that they draw the thigh-bone inwards, or adduct it, as their name expresses; for they take their fixed points of attachment above at the pelvis, and from thence concentrate their force upon the femur. Moreover, as they incline backwards somewhat, and are fixed to a projecting ridge (linea aspera) at

PLATE XLI.

The first layer of the muscles of the back is shown at the right side in this figure, and the second at the left.

No. 1. The tendinous part of the occipito-frontal muscle. 2. Its fleshy fibres, where they arise from the occipital bone. 3. The upper attachment of the sterno-cleido-mastoid muscle. 4. Part of the splenius capitis muscle, seen in the interval between the preceding muscle and the trapezius. 5, 5. The cervical and dorsal parts of the trapezius muscle. 6. The tendinous fibres by which it arises at the lower part of the neck and upper part of the back are rather long, and join with the fleshy structure so as to represent an oval or elliptic outline, as here indicated. 7. The external part of the muscle, proceeding to its insertion into the clavicle, the acromion, and the spine of the scapula. 8, 8. The broad fleshy part of the latissimus dorsi muscle. 9. The tendinous part which arises from the spines of the lumbar vertebræ: 10. that which arises from the sacral spines. 11. The attachment to the crest of the ilium. 12. The back part of the deltoid muscle. 13. Its insertion into the humerus. 14. Part of the long head of the triceps extensor muscle. 15. Its external head. 16. The infra-spinous muscle. 17. Part of the smaller teres muscle. 18. Part of the larger teres muscle. 19. A small piece of the greater rhomboid muscle:—(it is seen in its entire extent at the opposite sides, No. 28.) 20. The back part of the external oblique muscle, stretching down from the last rib to the crest of the ilium. 21. A small piece of the internal oblique muscle, seen in the angular interval between the external oblique and the latissimus dorsi. 22. The parietal bone, exposed by the removal of the occipito-frontal muscle. 23. The upper part of the occipital bone. 24. The splenius muscle. 25. Part of the complexus muscle, seen above the edge of the splenius. 26. The elevator muscle of the angle of the scapula (m. levator anguli scapulæ). 27. The smaller rhomboid muscle (m. rhomboideus minor). 28. The larger rhomboid muscle (m. rhomboideus major). 29. The clavicle. 30. The acromion process. 31. The spine of the scapula. 32. The greater tuberosity of the humerus. 33. Part of the humerus exposed by the removal of the deltoid muscle. 34. The upper part of the base of the scapula. 35. The part of the base of the scapula into which the smaller rhomboid muscle is inserted. 36. The lower part of the base of the scapula, into which the greater rhomboid muscle is inserted. 37. The lower angle of the scapula. 38. The supra-spinous muscle (m. supra-spinatus). 39. The broad fleshy part of the infra-spinous muscle; its fibres are seen converging to the tendon, 40, by which it is inserted. 41. The small teres muscle. 42. Part of the greater teres muscle. 43. The long head of the triceps muscle. 44. The external head of the triceps. 45. Part of the brachialis anticus muscle. 46. The lower part of the great serratus muscle. 47. Part of the sacro-lumbalis muscle: 48. Part of the longissimus dorsi:—these are indistinctly seen, as they are covered by a thin membrane called the vertebral aponeurosis. 49. The tendinous part of the serratus inferior; the four fleshy points by which it is inserted into the ribs are also shown. 50. The lower part of the lumbar muscles, viz. sacro-lumbalis and longissimus dorsi. 51. Part of the internal oblique muscle of the abdomen. 52. The spine of the ilium.

the back of the bone, they are enabled to turn it a little upon its axis so as to rotate it outwards, in which particular they conspire with another class of muscles, previously noticed, viz. the external rotators. The pectineus, also, owing to its line of direction, assists in bending the thigh upon the pelvis, in which effort it co-operates with the psoas and iliacus. These muscles may reverse their mode of action, and direct all their force upon the pelvis; but the thigh and the leg must, as a preparatory measure, be rendered steady and fixed, so as to give them secure points of attachment below, from which they can draw upon the pelvic bones. This mode of action is constantly required in the effort to stand upon one leg.

PLATE XXXV.

The first drawing here given, fig. 1, shows the muscles of the hip and thigh as they appear when viewed from the outer side. The extensor muscles, viz. those which straighten the leg and bring it into a right line with the thigh, are placed upon the front and sides of the thigh-bone, where they form a considerable fleshy mass: they have a common point of attachment at their lower extremity, where they are fixed to the patella, or knee-pan; they are marked, 15, the rectus; 18, the vastus internus; 19, the vastus externus: their insertion is indicated by the numbers 16, 17. A front view of these muscles has been already given in Plate XXXII, fig. 1, where they are marked 10, 15, 16, and their connexion with the patella and tibia is farther indicated by the numbers 11, 12, 13, 14: their description is given in pages 78, 79. Behind the thigh-bone a group of muscles is placed, which, as they are opposed in situation to those just now alluded to, so they are also their antagonists in action; they are named the flexor muscles of the leg. In this view we see but one of them, which is marked 20, 21, 22, which is the two-headed flexor muscle. It is obvious that if the muscles placed upon the front of the thigh can act on the leg, so as to bring it into a straight line with the thigh, or extend it, this muscle and its assistants will draw the leg backwards and bend it upon the thigh.

In the upper part of this drawing, we see about a third of the sartorius muscle, marked 3, 4; the tensor muscle of the fascia of the thigh, marked 9, 10; a part of the gluteus medius, 11, 12; and the gluteus maximus, 13, forming the prominence of the nates; whilst its insertion into the thigh-bone is indicated at 14. A front view of the tensor and sartorius muscles is given in Plate XXXII, fig. 1, Nos. 5, 8; they are described in page 78: a full view of the glutei muscles is given in Plate XXXIII, figs. 1, 2; their description will be found in pages 66, 67.

The flexor muscles are placed along the back part of the thigh, extending from the ischium to the upper part of the bones of the leg: their length is therefore considerable: they lie immediately under the skin and fascia in the greater part of their extent, their upper extremity being covered by the great gluteus muscle. They are shown in fig. 2 of this plate, and are marked 11, 14, 16, being three in number, and named the two-headed flexor, the semi-tendinous, and semi-membranous muscles.

The Two-headed Flexor muscle (m. biceps femoris, biceps flexor cruris) lies along the back part of the thigh, extending from the ischium, and then downwards to the head of the fibula. As its name implies, it consists of two parts or heads; of which one is attached to the ischium, and is therefore longer than the other, which is attached to the thigh-bone: the long head is marked No. 20, fig. 1, and 11, fig. 2; the short or femoral portion being indicated by No. 21, fig. 1, and 12, 12, fig. 2. The long head of the muscle is tendinous at its upper extremity, where it is attached to the tuberosity of the ischium; its fibres also for some way down are intimately connected with the semi-tendinous muscle: the short head is attached to the linea aspera of the femur, its fibres being interposed between those of the adductor magnus and vastus externus, where they reach as high up nearly as the insertion of the great gluteus. This head of the muscle is necessarily concealed by the long one, which lies behind it and overlays it, except in the neighbourhood of the knee, where its fibres project somewhat on either side of the tendon which is common to both: this fact is expressed by the references 12, 12. The fibres of the short head incline backwards as they descend and join with those of the long head. A tendon (13), common to both, is continued downwards, and becomes inserted into the head of the fibula.

The Semi-tendinous muscle (m. semi-tendinosus) lies along the back part of the thigh, extending from the tuberosity of the ischium to the upper and inner part of the tibia; its fleshy part is marked

14, and the lower or tendinous portion 15. This muscle is attached by its upper extremity to the back part of the tuber ischii, and for some way down its fibres are connected with those of the long head of the biceps: lying along the inner side of the latter, it continues in close apposition with it as far as the lower third of the thigh, where the two muscles are observed to diverge; the one inclining to the outer, the other to the inner side of the ham or popliteal space. The tendon of the semi-tendinous muscle passes along the posterior and inner aspect of the knee-joint, and then turns forwards somewhat to be inserted into the upper part of the tibia, where its tendon rests a little below that of the gracilis, and under cover of the sartorius. The muscle is tendinous and fleshy at its upper part, fleshy in the middle, and altogether composed of a flat tendon in the rest of its extent; it rests in nearly its entire length upon the semi-membranous muscle, the posterior aspect of which is depressed and concave, as if it were adapted to it.

The Semi-membranous muscle (m. semi-membranosus) has the same extent as the preceding, being stretched from the tuberosity of the ischium to the upper end of the tibia: it is overlapped by the preceding muscle in a considerable part of its extent; but as its body is broader, particularly at the lower end, its fibres project farther into the popliteal space, so as to approach nearer to the biceps muscle; and higher up, towards the middle of the thigh, it projects inwards, so as to be seen between the semi-tendinous and gracilis: the double references, 16, 16, indicate these facts. The upper end of the semi-membranous muscle is fixed to the back part of the tuberosity of the ischium, where it is overlaid by the biceps and semi-tendinous muscles; the tendon of origin widens somewhat so as to become membranous, and the muscular fibres which arise from this descend with some degree of obliquity, forming a fleshy belly. From the outer border and lower end of the fleshy part a strong tendon is prolonged, which is fixed into the inner tuberosity of the tibia at its posterior surface; this tendon is marked 17; from it a considerable number of fibres are reflected, and pass obliquely behind the knee-joint, where they become blended with its posterior ligament, 18: a membranous expansion is also continued from it over the popliteal muscle; and a third tendinous process passes forwards upon the border of the inner tuberosity of the tibia into which it becomes fixed.

Actions.—The individuals of this group are commonly termed the ham-string muscles: they diverge from one another in such a way as to leave between them an interval, commonly known as the ham or popliteal space; the biceps forming its outer border, the semi-tendinous and semi-membranous muscles the inner one. When in action, by taking their fixed points of attachment above at the ischium, they concentrate their force upon the bones of the leg, to draw them directly backwards; so that the leg is made to form an angle with the thigh, or, in other words, is bent or flexed upon it. When they act together, the flexion is directly backwards; but a certain degree of inclination either inwards or outwards may be given to it, according as a greater degree of effort is made by the biceps or the others. These muscles can reverse their line of action, so as to draw upon the ischium and the femur; but, as a preparatory effort, the leg must become relatively the more fixed point, as is the case in the standing posture.

The external rotators are exhibited in this drawing, 5, 6, 7, 8; other views of them are given in Plate XXXIII, figs, 1, 2, and in Plate XXXIV, figs. 1, 2, 3: they are described in pages, 68, 69.

PLATE XXXVI.

The muscles placed along the inner and back part of the thigh are shown in fig. 1; also two of those which arise within the pelvis, viz. the internal obturator muscle, No. 6, and the pyriformis, No. 7. For the names of the other muscles see the references, page 72: they have been already described with the flexors, adductors, and rotators, to which they belong.

Fig. 2. The muscles placed at the fore part and outer side of the leg are here brought into view by removing the skin and the fascia which binds them down. When looked at in this way, it will be observed at once that they form three groups, the first occupying the interval between the two bones of the leg; viz. the anterior tibial muscle, 7, 8; the extensor of the great toe, 9, 10; the common extensor of the toes, 11, 12, and the third peroneal muscle, 14, 15: the second group consists of the two peroneal muscles, which rest upon the outer side of the peronè, or fibula; whilst the third, lying still farther back, and marked 24, 25, 26, forms the calf of the leg.

The Anterior Tibial muscle, 7, 8, (m. tibialis anticus,) extends from the upper part of the leg to the inner edge of the sole of the foot; its upper part consisting of rather a thick, fleshy, and tendinous body,

the lower being a flat and rather strong tendon. The drawing shows that its fibres are attached to the outer tuberosity of the tibia, and to the flat surface of the bone beneath it, for a considerable way down; several fibres also are attached to the fascia of the leg, and to a tendinous process between this and the long extensor, whilst others more deeply placed are connected with the interosseous ligament. The tendon which extends from the fleshy fibres rests upon the lower end of the tibia, passes in front of the ankle-joint, inclining at the same time inwards, and becomes inserted into the inner side of the first cuneiform bone and the neighbouring part of the first metatarsal bone. Whilst passing in front of the ankle-joint, it is bound down by the annular ligament, which is here represented somewhat like a broad tape crossing the tendons and retaining them in their situation.

The Long Extensor muscle of the toes, 11, 12, 13, extends from the upper end of the tibia to the third row of digital bones: its upper extremity is fleshy, and somewhat aponeurotic; and the lower consists of a tendon which splits into four processes destined for the four smaller toes. The points to which its fleshy fibres are attached are,—the external tuberosity of the tibia, a little farther back than the anterior tibial muscle,—the head of the fibula, and the anterior surface of that bone for some way down; also the interosseous ligament, and the tendinous processes interposed between it and the tibialis anticus on one hand, and the peronei on the other. The fibres derived from these different points of attachment differ somewhat in their direction as they descend; the upper set descend vertically, those lower down incline obliquely forwards and downwards, all terminating in a tendon which gradually resolves itself into the processes already alluded to; these, as they pass over the upper surface of the foot, diverge a little as they proceed to their destination, and finally run upon the two first rows of the digital bones and become fixed into the third.

The Third Peroneal muscle (m. peroneus tertius) is placed along the fore part of the fibula in the lower third of its extent, being close to the edge of the common extensor muscle, with which it is intimately united at its origin and for some way down, so as to appear a part of it. It is not unfrequently called the anterior peroneal muscle, as it lies before the fibula, which separates it from the other two muscles of the same name: hence it is readily distinguished from these by its situation, and quite as decidedly in its action, for it bends the foot upon the leg; whilst they, on the contrary, carry it backwards by means of the change of direction which their tendons suffer whilst passing behind the lower end of the fibula. As, then, the third peroneal muscle is intimately united at its origin with the common extensor, and combines with it in its action on the foot, it may be considered a part of it. The fibres of this muscle will be observed to be fixed along the lower third of the fibula and the neighbouring part of the interosseous ligament; they incline obliquely forwards to a tendon which lies along the anterior edge of the muscle, and which, after passing under the annular ligament of the ankle-joint, becomes inserted into the fifth metatarsal bone.

The Extensor muscle of the great toe (m. extensor proprius pollicis) lies in the interval between the long extensor of the toes and the anterior tibial muscle, by which its upper part is altogether concealed; but its tendon, No. 9, comes forward, so as to be seen along the lower third of the leg, and also

PLATE XLII.

The fourth layer of the muscles of the back is here shown; the serratus posticus and splenii having been sufficiently indicated in the preceding plate.

No. 1. The occipital bone. 2, 2. The mastoid part of the temporal bone. 3, 3. The complexus muscle at each side. 4, 4. Its digastric portion, which is often considered a separate muscle, and named biventer cervicis. 5, 5. The trachelo-mastoideus muscle at each side; at the left side it is everted to show the tendinous points by which it arises. 6, 6. The cervicalis ascendens muscle at each side, forming a continuation of the sacro-lumbalis. 7, 7. The transversus cervicis muscle, forming a continuation of the longissimus dorsi. 8, 8. A slip of muscular fibre, usually passing from the longissimus dorsi to the complexus. 9, 9. The upper part of the sacro-lumbalis muscle at each side; at the right side, the tendinous points by which it is attached to the angles of the ribs are seen forming a series from below upwards; at the left side, the muscle is drawn outwards to show the series of accessory bundles of fibres derived from the ribs, and by which the muscle is strengthened and prolonged upwards: these are seen in the space from 10 to 10. 11, 11. The longissimus dorsi muscle at each side; at the left side it is drawn inwards to show its tendinous points of insertion. 12, 12. The point at which the sacro-lumbalis and longissimus dorsi of each side become separable from one another. 13, 13. The mass of tendinous and muscular fibres forming the deep-seated lumbar muscles—erectores spinæ, and which higher up separate a little at 12, 12, so as to form the sacro-lumbalis and longissimus dorsi. 14, 14, 14, 14, 14, 14. The series of tendinous and fleshy fibres, which lie close to the spinous processes, and are attached to them, forming, when taken together, the spinalis muscle. 15, 15. The crest of the ilium at each side. 16. The lower extremity of the spine.

Plate 42.

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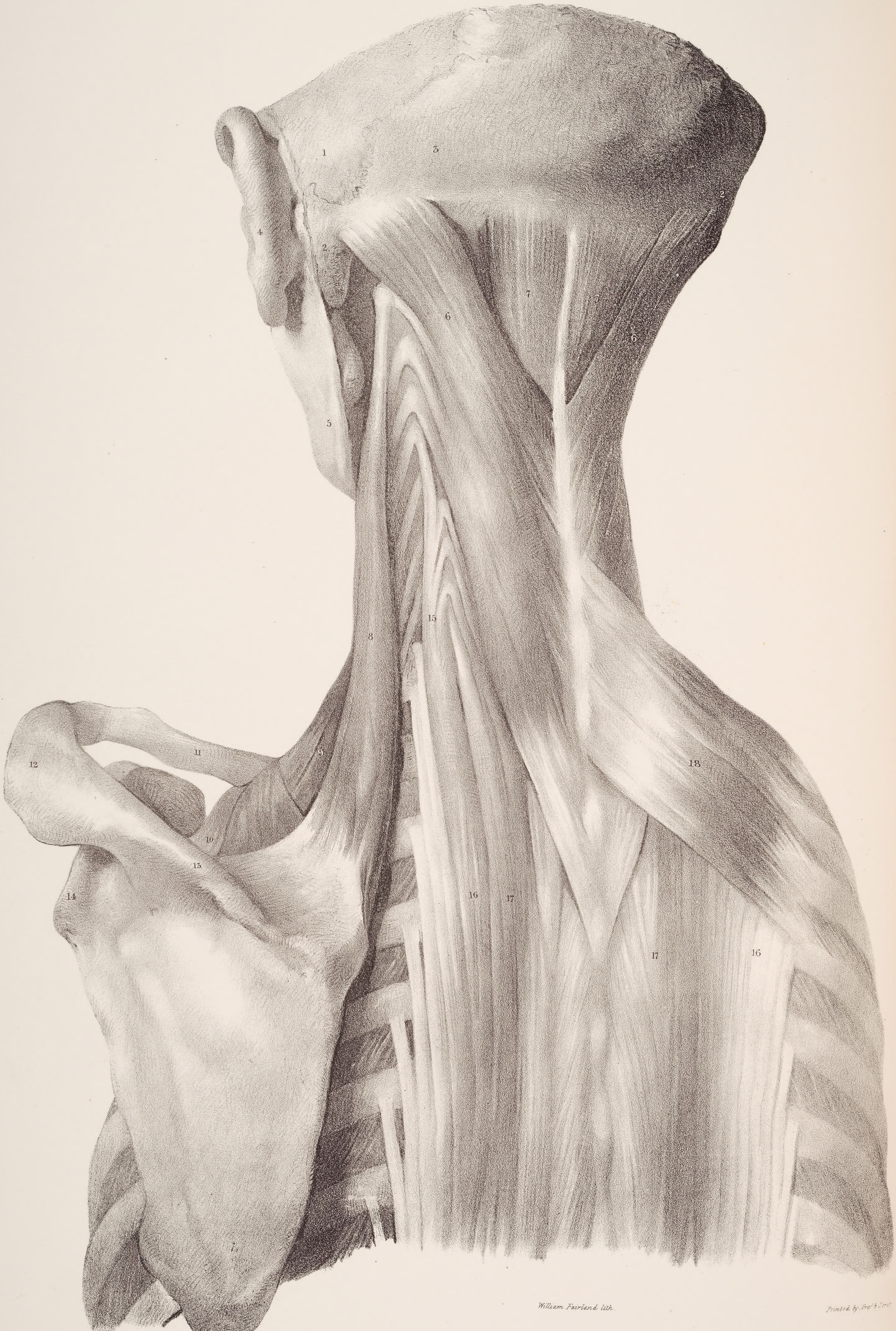
Plate 45.



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Printed by Gra.t & Sore.t

J. Walsh del.t

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on the upper surface of the foot, where it is marked 10. From the situation which the muscle occupies it is necessarily compressed and flat. It arises from the inner surface of the fibula, in the middle third of its extent, or a little higher up; also from the neighbouring part of the interosseous ligament for some way farther down; the fleshy fibres run obliquely forwards into a tendon which, as here shown, forms the anterior border of the muscle, and is the only part that can be seen in this view. The tendon passes beneath the annular ligament, and upon the upper surface of the foot, to reach the second bone of the great toe, into which it is fixed.

Actions.—The first effect of the long extensor muscle of the toes is to straighten or extend the different osseous pieces of which they consist, and at the same time to lift them from the ground: in these particulars it is the direct antagonist of the flexor muscles, which lie at the back of the leg, and whose tendons are prolonged through the sole of the foot to the digital bones. The power of the muscle is not, however, confined to the toes; it can be made to act upon the foot and draw it up so as to bend it upon the leg; this it is enabled to do by the change which is given in its direction as it passes under the annular ligament. In this latter effort it is assisted by the other muscles which lie beside it, for the anterior tibial and third peroneal muscles are the direct flexors of the foot; and the long muscle of the great toe, after having acted upon the digital bones, can, by continuing its effort, combine with those just named, so as to become a flexor of the foot. Finally, when the foot is rendered relatively the more fixed point, as in the standing posture, these muscles can be made to act from below, and draw upon the bones of the leg so as to bring them forward and maintain them erect over the foot. There is a short extensor muscle of the toes which is partly seen in this drawing: it consists of a narrow fleshy part, which rests far back upon the foot, No. 22, and of four tendinous processes, 23, 23, 23, 23, which are continued onwards to the four inner toes; it obviously assists the long extensor, but from the difference in its line of direction it is enabled not only to straighten the toes, but also to incline them a little outwards, or it may so modify the action of the long extensor, when both muscles act together, that they are simply extended and drawn backwards without receiving any inclination either inwards or outwards.

The Long Peroneal muscle (m. peroneus longus, vel primus) is placed at the outer side of the leg, along which it descends to the outer ankle, behind which it passes; and, after resting upon the heel-bone, it runs obliquely across the sole of the foot, to be fixed into the first metatarsal bone: its fleshy part is marked 16, its upper attachment 17, the tendon which is prolonged from it in the middle and lower third of the leg 18; where it runs upon the calcaneum, after having passed behind the external ankle, its position is indicated by 19; below this point it is observed to turn round the border of the foot and pass deeply across its under or plantar surface. It is attached by its upper extremity to a small part of the tuberosity of the tibia, to the head of the fibula, and the outer surface of the bone in about one-third of its length; some of its fibres are also connected with the fascia of the leg, and the tendinous septa between it and the contiguous muscles. From the fleshy fibres thus arising, a flat tendon is prolonged downwards, resting for some way on the short peroneal muscle; it passes behind the outer ankle, where it is bound down by a fibrous band, which, with a groove in the bone, forms a sort of canal for its transmission; whilst passing over the heel-bone (calcaneum), it is also retained in its situation by a fibrous band. It then runs in a groove beneath the cuboid bone, where it is also confined by tendinous fibres; and finally it becomes fixed to the tubercle at the posterior extremity of the first metatarsal bone.

PLATE XLIII.

When the layers of muscles shown in the preceding plate are removed, the splenius, part of the complexus, and the serratus superior are brought into view.

No. 1. The posterior part of the left parietal bone. 2, 2. The mastoid process of the temporal bone at each side. 3. The occipital bone. 4. The left ear. 5. The skin covering the lower jaw-bone. 6, 6. The splenius muscle at each side. 7, 7. The upper part of the complexus muscle at each side, seen in the interval left by the divergence of the splenii. 8. The elevator muscle of the angle of the scapula;—the four tendinous processes by which it arises from the transverse processes of the upper cervical vertebræ are shown by drawing the muscle a little outwards: lower down, three similar tendinous processes are seen; they form part of the attachment of the posterior scalenus muscle to the tubercles of the transverse processes of the cervical vertebræ. 9. Part of the posterior scalenus muscle. 10. Part of the omo-hyoideus muscle, arising from the upper border of the scapula. Between 9 and 10 a small part of the serratus magnus is seen. 11. The clavicle. 12. The acromion process. 13. The spine of the scapula. 14. The neck of the scapula. 15. The cervicalis ascendens muscle, being the cervical prolongation of the sacro-lumbalis. 16, 16. The sacro-lumbalis muscle at each side. 17, 17. The longissimus dorsi muscle at each side. 18. The upper serratus muscle (m. serratus posticus superior).

The short Peroneal muscle (m. peroneus brevis, vel secundus) is shorter than the preceding, and is overlapped by it, but not concealed, as its fibres project so as to be seen in the middle and lower part of the leg on each side of the tendon of the long peroneal muscle. This fact is expressed by the double references 20, 20; its tendon, 21, reaches to the fifth metatarsal bone. This muscle is attached to the outer surface of the fibula for half or a little more of its length; the fleshy fibres as they descend run, with varying degrees of obliquity, into a strong tendon which passes behind the external ankle, lying closer to the bone than the long peroneal muscle; it then inclines obliquely forwards to be fixed to the end of the fifth metatarsal bone.

Actions.—When these muscles take their fixed points above, and draw upon the foot, they can readily extend it; this they are enabled to do by the change which occurs in their direction as they wind round the ankle: they can also elevate somewhat the outer border of the foot. When the foot is fixed by being pressed against the ground, these muscles will reverse their line of action, and draw upon the leg, so as to assist in maintaining it in the erect position. Thus, in the effort to stand upon one leg, whenever it is desired to move it a little backwards or forwards upon the foot, the group of muscles placed before the bones, and those behind them, act alternately as motors and moderators; whilst the peroneal muscles act in a different way, and become in a manner fixors of the leg. The weight of the body in such a case as this tends to incline the leg and foot inwards; but the long peroneus, pulling as it were from its fixed point in the sole of the foot, and having its line of direction changed by turning round its outer border and behind the external ankle, is enabled to draw upon the outer side of the bones of the leg, and thereby counteract the influence of the weight of the body, which tends to press them inwards.

Behind the peroneal muscles, we see in this drawing the outer side or border of the great muscles which form the calf of the leg, viz. the gastrocnemius, 24, and the soleus, 25: other views are given of these same muscles in Plate XXXVII, fig. 2, and Plate XXXVIII, figs. 1, 2.

PLATE XXXVII.

The muscles of the leg are here drawn as they are seen from its outer and inner sides. The position of the different tendons which pass in front of the ankle-joint are seen in fig. 1, where the annular ligament is removed in order to show their relative position at the point referred to. The tendon of the tibialis anticus is marked 18, 19; that of the extensor communis, 21, 22; of the peroneus tertius, 23, 24; and the extensor of the great toe, where it begins to be apparent, is marked 25; the position of the peroneal tendons, after passing behind the external ankle, is indicated by Nos. 11, 12. The tendons of the two inner hamstring muscles, with the gracilis and sartorius, are shown as they pass along the inner side of the knee, in fig. 2, Nos. 8, 10, 11, 12. The position and direction of the tendon of the anterior tibial muscle is indicated by the Nos. 18, 18; and the three muscles which pass behind the inner ankle are indicated by the Nos. 20, 21, 22.—See references page 73.

PLATE XXXVIII.

In fig. 1, the muscles of the calf of the leg are shown as they present themselves to view when the skin and fascia are dissected off: the gastrocnemius muscle is seen in its entire extent, 4, 4, 5, 5; and its long tendon, 6. Part of the soleus, where it projects beyond the preceding, is indicated by No. 7, 7: the whole of this muscle is brought into view in fig. 2, No. 7, 7, by the removal of the gastrocnemius.

The Gastrocnemius muscle forms, as its name implies, the calf of the leg. It is thick and rounded at its posterior aspect, and plain in front, where it rests on the soleus. Its upper extremity consists of two processes or heads, 4, 4, which are attached to the back part of the condyles of the thigh-bone, leaving an interval between them for the passage of the popliteal vessels; lower down, they unite and form a considerable fleshy mass. Below the middle of the leg, the muscular part ends in a broad strong tendon called tendo Achillis, which grows narrower and thicker as it descends, and is finally fixed to the posterior extremity of the heel-bone.

The Plantaris muscle, fig. 2, No. 4, consists of a small tapering fleshy portion, and of a long narrow tendon, 5, which reaches as far as the heel-bone. It is attached at its upper extremity to the back

part of the outer condyle of the thigh-bone, where it is concealed by the outer head of the gastrocnemius, and also to the posterior ligament of the knee-joint. It will be found to incline inwards as it descends, resting on the popliteus and soleus muscles: its tendon is inserted, together with the tendo Achillis, into the calcaneum.

The Soleus muscle, fig. 2, No. 7, 7, is thick and broad at its middle, but narrows towards its extremities, particularly the upper one, so as to assume the form of an elongated oval. It is attached to the tibia and fibula, and, in the interval between these bones, to a tendinous process stretched across from the one to the other: through this interstice the popliteal vessels pass downwards. The division of the muscle into two parts or heads is at first scarcely perceptible; but it will be found that the outer one is attached to the head of the fibula, and to the posterior surface of the bone for a third of its length, whilst the inner one is fixed to the middle third of the tibia as it commences below the border of the popliteus. The fleshy fibres converge as they descend, and become fixed into the tendo Achillis at its anterior surface.

Actions.—These muscles act powerfully in the different efforts which we are required to make in running, walking, and lifting burdens. They take their fixed points above, and pull on the heel-bone, so as to lift it from the ground; thereby making the foot to represent an inclined plane, and give an impulse to the body upwards and forwards. When the body is in this way raised on one foot, the opposite limb can be carried forward without difficulty, and almost in a straight line. Were we not able to make this preparatory movement, each leg should necessarily describe, whilst being carried forward in progression, a considerable arch of a circle, as may be seen in those who use a wooden leg. In the standing posture these muscles take their fixed points at the heel, and act on the bones of the leg, maintaining them in the erect position, and preventing them from obeying the influence of the weight of the body, which tends to incline them forwards.

PLATE XXXIX.

The muscles which are situated deeply at the back of the leg, in close contact with the bones and the interosseous ligament, are shown here; they may be said to form a layer by themselves, as they are separated from the muscles of the calf of the leg by a layer of membrane, (the deep fascia of the leg,) and by the posterior tibial blood-vessels and nerves. When the membrane and vessels just named are removed, the muscles now to be described become exposed in their entire extent, so far as they are in relation with the bones of the leg; but, as part of them extends into the sole of the foot, some additional dissection is required in the latter situation. There are here placed four muscles; viz. the popliteal, or muscle of the ham, so called from its relation to the back part of the knee-joint; the long flexor of the toes, the flexor of the great toe, and the posterior tibial muscle.

The Popliteal muscle (m. popliteus), fig. 1, No. 3, is placed at the flexure of the knee-joint, extending obliquely across it from the external condyle of the thigh-bone downwards and inwards to the tibia. It commences by a flat, strong tendon, which is fixed to a depression at the outer side of the condyle; the muscular fibres spread out gradually as they descend from the tendon, and become inserted into a triangular space marked upon the upper part of the tibia, and which is seen in fig. 2, the fibres of the muscle being removed. This muscle is compressed and flat: its form is irregularly triangular; its upper part or origin consists of the tendon already spoken of, the lower being a mixture of fleshy and tendinous fibres; its posterior surface supports the popliteal vessels and nerves; the anterior is in close relation with the knee-joint, its tendon being connected with the external semilunar cartilage and the synovial or lining membrane of the joint.

The Long Flexor muscle of the toes (m. flexor longus digitorum pedis), fig. 1, Nos. 8, 9, extends from the upper part of the tibia to the last row of digital bones. Its fibres commence to be fixed to the tibia immediately below the oblique line which marks the attachment of the soleus, and continue to arise from the bone for a considerable way downwards; the fleshy fibres will be observed to incline obliquely backwards as they descend, and to terminate in a tendon placed along the posterior edge of the muscle, and which, after running behind the inner ankle, is prolonged into the sole of the foot. When examined in the latter situation, the tendon is found to divide into four slips, which spread out towards the four smaller toes; each slip passes through a fissure formed for it in a similar tendinous process derived from the short flexor muscle, and finally becomes fixed to the last bone of the toe. Where the tendon slides behind the ankle, it overlays that of the posterior tibial muscle, No. 7; and

both are retained in their proper situation by a fibrous sheath, which, however, is divided into two compartments, so that each tendon moves in a separate groove or rather canal. The surfaces here in contact are lined by a membrane which secretes a fluid calculated to lessen the effects of friction.

The Long Flexor muscle of the great toe, Nos. 10, 11, (m. flexor longus pollicis,) lies along the posterior surface of the fibula, or outer bone of the leg, and is prolonged into the foot as far as the last bone of the great toe. Its fibres are fixed to the fibula for about two thirds of its length, and slightly to the interosseous ligament, from which they incline backwards to a tendon placed along its posterior border: the tendon inclines inwards, and runs along a groove marked upon the posterior surface of the tibia; it then passes behind the astragalus, or die-shaped bone, and under the inner edge of the calcaneum, thereby reaching the sole of the foot; in this latter situation it is connected with the long flexor muscle of the toes by a piece of tendon, and gradually inclines inwards, so as to pass beneath the first metatarsal bone, and between the two heads of the short flexor muscle of the great toe, after which it is inserted into its second bone.

The Posterior Tibial muscle (m. tibialis posticus), fig. 1, Nos. 6, 7; fig. 2, Nos. 3, 4, is partly concealed by the two preceding muscles, but its upper end extends higher in the leg, occupying the interstice between the two bones; this part is marked No. 6, in fig. 1: the rest is overlaid by Nos. 10 and 11; but its tendon, No. 7, is partly seen as it runs behind the inner ankle. The fibres of the posterior tibial muscle are attached to the surface of the tibia, commencing below the oblique line which bounds the insertion of the popliteal muscle, and continue to be fixed to the bone for some way down; many of them also arise from the posterior surface of the fibula for about two thirds of its length, and from the interosseous ligament. The fleshy fibres incline backwards to a tendon by which the muscle is prolonged into the sole of the foot: this tendon slides in a groove behind the inner ankle, and is fixed to a projection upon the under surface of the scaphoid bone; some of its fibres are prolonged to the inner cuneiform bone, and to the second and third metatarsal bones. As the fibres at the upper end of the muscle are attached to the tibia and the fibula, an interval necessarily exists between them, corresponding with an aperture in the interosseous ligament, for the transmission of the anterior tibial vessels: this fact is indicated in the drawings.

Actions.—The popliteal muscle, when it takes its fixed point above, can assist the flexor muscles in bending the leg upon the thigh; and, by acting on the inner border of the tibia, it will incline the corresponding side of the leg and foot inwards: it can scarcely be said to flex the thigh upon the leg, but it may exert some influence in giving steadiness to the joint in the different movements of the limb.

The long flexor muscles, when first brought into action, draw on the bones of the toes so as to

PLATE XLIV.

Fig. 1. The small complexus muscle is here shown.

No. 1. The mastoid part of the temporal bone of the right side. 2. The under part of the occipital bone. 3. The small complexus muscle, more usually called trachelo-mastoid (m. trachelo-mastoideus).

Fig. 2. The large complexus muscle is here given by itself.

No. 1. The mastoid part of the temporal bone. 2. The under part of the occipital bone. 3, 3, 3, 3. The anterior surface of the bodies of the vertebræ. 4, 4, 4, 4. The upper ribs. From 5 to 6 are the pointed tendinous processes by which the great complexus muscle arises from the transverse processes of the cervical vertebræ. From 7 to 8 are the processes by which it arises from the transverse processes of the upper dorsal vertebræ. 9. The lower part of the body of the great complexus muscle, formed by the union of the several processes derived from the dorsal vertebræ;—10. the upper part, formed by the union of those derived from the cervical vertebræ.

The muscular apparatus connecting the two upper vertebræ of the neck with the base of the skull is shown in the drawings, figs. 3, 4.

Fig. 3. No. 1, 1. The mastoid process of the temporal bone at each side. 2, 2. The styloid process at each side. 3. The posterior surface of the occipital bone. 4, 4. The extremity of the transverse processes of the atlas, or first cervical vertebra. 5. The tubercle at the middle of the posterior arch of the atlas. 6. Part of the arch of the atlas at the right side, exposed by the removal of the superior rectus and superior oblique muscle. 7. The end of the spinous process of the second vertebra. 8. The superior oblique muscle (m. obliquus superior). 9, 9. The inferior oblique muscle at each side (m. obliquus inferior). 10. The greater straight muscle (m. rectus major posticus). 11, 11. The smaller straight muscle (m. rectus minor posticus). From 12 to 12 are seen the interspinal muscles (m. interspinales).

Fig. 4. No. 1. The mastoid process of the right temporal bone. 2. The under part of the occipital bone. 3. The posterior part of the arch of the atlas, or first cervical vertebra. 4. The transverse process of the atlas. 5. The end of the spinous process of the second vertebra. 6, 7. The arches of the third and fourth cervical vertebræ. 8, 9. The two upper interspinal muscles.

Plate 44.

Fig. 1.

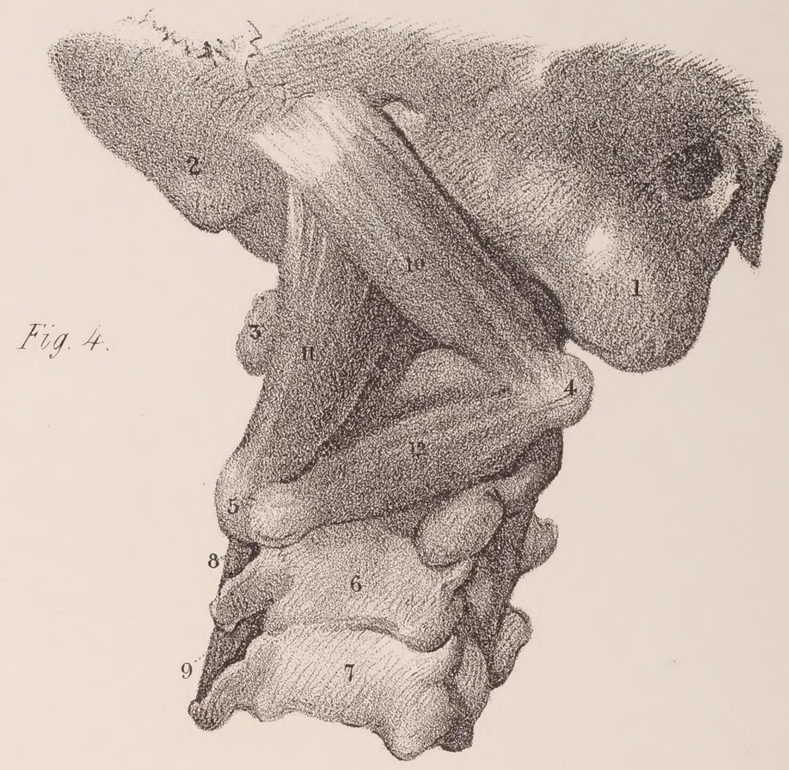

Fig. 4.

Fig. 2.

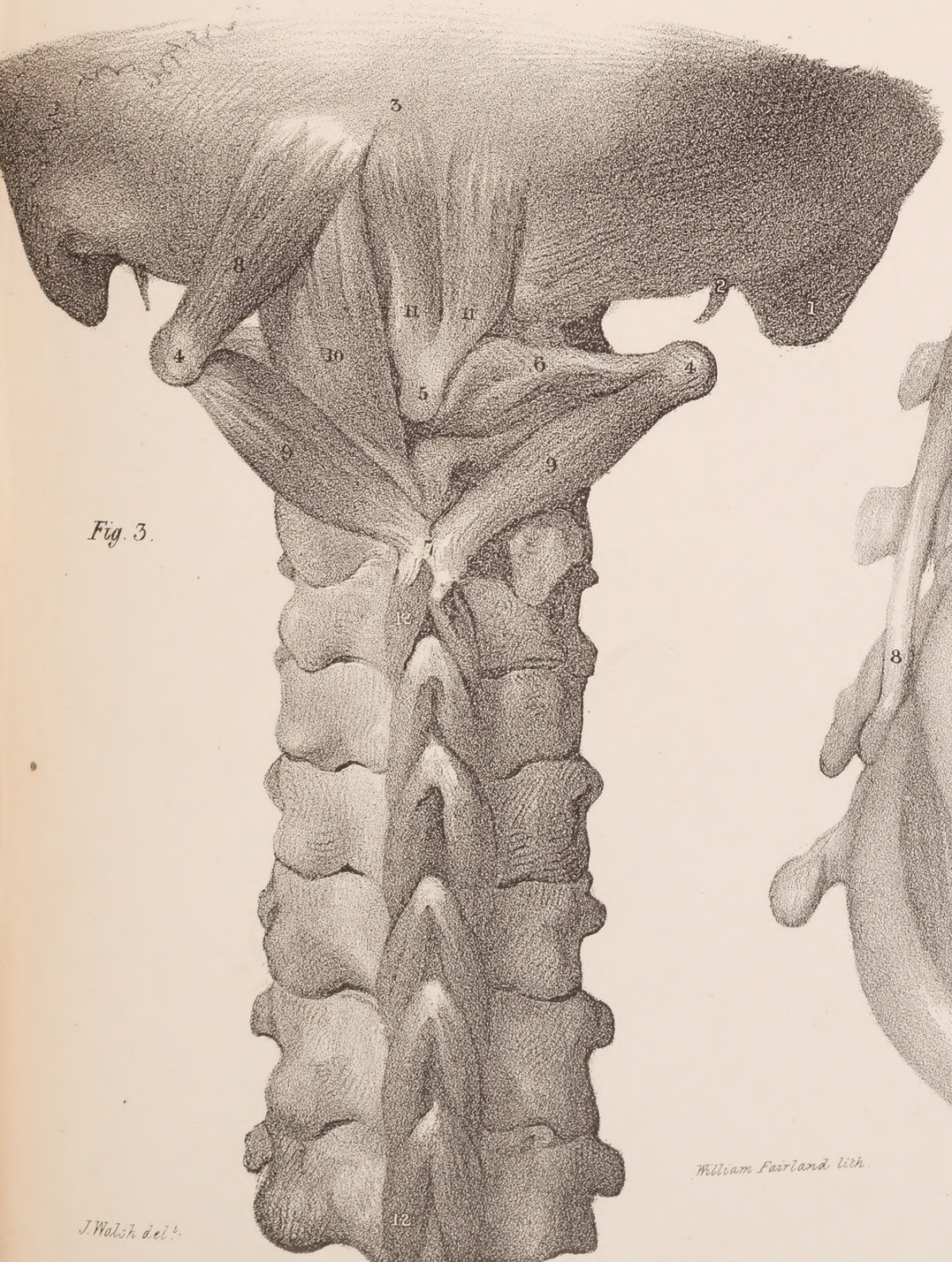

Fig. 3.

J. Walsh del.

William Fairland lith.

London, John Taylor, Upper Gower St.

Printed by Graf & Soret.

Plate 45.

Fig. 1.

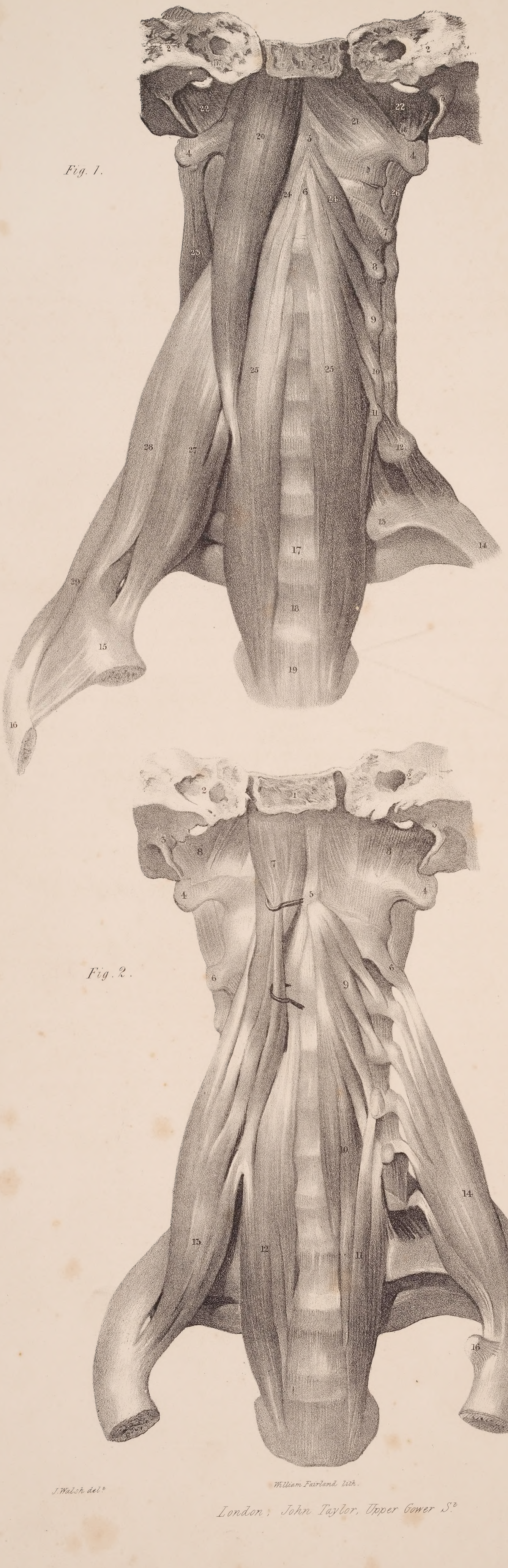

Fig. 2.

J. Walsh del.t
William Fairland lith.
Printed by Graf & Soret
London; John Taylor, Upper Gower St.t

bring them into the bent or curved position. By continuing their effort they extend the foot, or bring it (as nearly as the structure of the ankle-joint will admit) into a line with the leg: this they are enabled to do by the change of direction given to their tendons as they pass behind the projection of the ankle. The posterior tibial muscle is a principal agent in extending the foot upon the leg; so are the two peronei; and they can execute this movement in what is ordinarily considered the relaxed position of the limb, when the leg is bent on the thigh. In the extended state, the muscles of the calf of the leg act with great power on the foot, by drawing on the calcaneum. All these agents are employed in the effort to stand on tip-toe, and in every muscular exertion, such as jumping, which is an uplifting of the body from the feet as from a spring. In the standing posture these muscles are made, by an effort of the will, to reverse their mode of action and draw upon the bones of the leg, so as to assist in maintaining them erect upon the foot, or in bringing them into that state if they have been previously bent forwards.

PLATE XL.

The muscles in the sole of the foot are shown in these drawings in the order in which they present themselves when dissected; they are arranged in layers, which are taken successively one after the other.

In fig. 1. are shown the muscles which form the first layer in the sole of the foot; they are three in number; one of them corresponds with the inner side of the foot and great toe; it is marked 2, 3, 4, and is named abductor pollicis: another lies along the outer border of the foot and little toe, and is marked 9, 10; it is the abductor of the little toe: the third occupies the interval between the two preceding muscles, and is marked 5, 6; it is named the short flexor of the toes:—these are brought into view by removing the skin and the plantar fascia.

The Abductor muscle of the great toe (m. abductor pollicis pedis), 2, 3, is attached to the inner border of the calcaneum or heel-bone, where it forms a protuberance, and to the internal annular ligament; some of its fibres are also fixed to the plantar fascia: its fleshy fibres will be observed to end in a tendon which is fixed to the base of the first bone of the great toe at its inner border; it is also intimately connected with the inner division of the short flexor of the great toe, No. 14.

The Abductor muscle of the little toe (m. abductor digiti minimi) is attached to the outer border and under surface of the calcaneum, close to its outer tubercle, and also to the plantar fascia: the fleshy

PLATE XLV.

The muscles in immediate connexion with the cervical part of the spine (its anterior surface) are shown in these drawings. The bones of the head and face are removed, with the exception of a small part of the basilar process of the occipital bone, and part, at each side, of the temporal bone.

Fig. 1. No. 1. Part of the basilar process of the occipital bone. 2, 2. The petrous portion of the temporal bone. 3, 3. The styloid process of the temporal bone. 4, 4. The transverse processes of the first vertebra. 5. The tubercle at the fore part of the first vertebra. 6. The ridge at the fore part of the second vertebra. 7, 8, 9, 10, 11, 12. The transverse processes of the cervical vertebræ, from the second to the seventh. 13, 14. The head and body of the first rib at the left side. 15. The first rib at the right side. 16. The second rib. 17, 18, 19. The bodies of the three upper dorsal vertebræ. 20. The great, or long anterior straight muscle of the head (m. rectus capitis anticus major). 21. The small, or short anterior straight muscle (m. rectus capitis anticus minor) of the left side; it is brought into view by the removal of the long straight muscle, which overlays it. 22. The lateral straight muscle (m. rectus lateralis). 23. Part of the levator scapulæ muscle. 24, 24. The upper, or smaller division of the long muscles of the neck (m. longi colli). 25, 25. The lower, or long portion of the same muscles. 26. The posterior scalenus muscle of the right side. 27. The anterior scalenus muscle.

Fig. 2. No. 1. The basilar process of the occipital bone. 2, 2. The petrous portion of the temporal bone. 3, 3. The styloid process at each side. 4, 4. The transverse processes of the first cervical vertebra. 5. The tubercle at the fore part of the first vertebra. 6, 6. The transverse processes of the second cervical vertebra. 7. The great anterior straight muscle of the head (m. rectus capitis anticus major) at the right side, everted so as to show its mode of connexion with the transverse processes from which it arises. 8, 8. The recti laterales muscles. 9. The upper, or small portion of the longus colli muscle. 10, 11. Its middle and lower portions. 12. The lower part of the same muscle at the right side. 13. The anterior scalenus muscle at the right side. 14. The posterior scalenus muscle at the left side. 15. Its second origin, or attachment to the second rib. 16. Part of the tendinous attachment of the anterior scalenus muscle left in connexion with the first rib, the rest being removed in order to expose fully the posterior scalenus muscle.

fibres end in a tendon which passes beneath the head of the fifth metatarsal bone, and is inserted into the first bone of the little toe at its base.

The short Flexor of the toes (m. flexor brevis digitorum pedis—flexor perforatus), 5, 6, lies along the middle of the sole of the foot: it is attached to the under surface of the calcaneum, close to its great tuberosity; its fibres are connected also with the plantar fascia, and with membranous partitions which separate it from the abductor of the great toe and that of the little toe; towards its fore part, the body of the muscle divides into four pointed processes, which are prolonged by means of separate tendons, 7, 7, 7, 7, to the second bones of the four smaller toes, into which they are fixed. Each tendon presents a fissure and a groove, through which a corresponding tendon of the long flexor tendon is transmitted, which is indicated by the references 17, 17; the points at which the tendons of the short flexor muscles terminate are indicated by the numbers, 8, 8, 8, 8.

Fig. 2.—The second layer of muscles in the sole of the foot consists of the tendon of the long flexor muscle of the great toe, 5, 6; the tendon of the long flexor muscle of the smaller toes, 7, 8, 9, with its accessories or assistants, viz. the accessory flexor 12, 13, and the lumbricales 11, 11, 11, 11. The long tendons here named have been already described with the muscles to which they belong, pp. 87, 88.

The Accessory muscle (m. flexor accessorius), 13, commences by two pointed processes, 12, 12, attached to the plantar surface of the calcaneum; they soon unite and form a flat fleshy mass, which at its termination becomes tendinous, and is fixed to the tendon of the long flexor muscle where it is about to divide into its digital processes.

The Worm-like muscles (m. lumbricales) are four in number: each is rounded and tapering, and is attached by one end to the tendon of the long flexor muscle near its point of division, and by the other is fixed to the base of the first bone of the corresponding toe at its inner side.

The other muscles in this figure are named in the references at page 80.

Fig. 3.—The third layer of plantar muscles is here shown, being brought into view by the removal of the long flexor tendons: they consist of the adductor muscle of the great toe; the short flexor; the transverse muscle of the foot, No. 12; and the short flexor of the little toe, No. 9.

The Adductor muscle of the great toe (m. adductor pollicis), No. 8, is placed obliquely in the sole of the foot, forming a thick fleshy bundle; it is attached to the external and middle cuneiform bones, and to the ends of the third and fourth metatarsal bones, as well as to the sheath of the long peroneal muscle: from these points it inclines inwards, and becomes tendinous; after which it joins with the outer head of the short flexor muscle, previously to its becoming fixed into the base of the first bone of the great toe: it is also connected with the external sesamoid bone, which may be considered an appendage to it.

The Short Flexor muscle (m. flexor brevis pollicis pedis) of the great toe is overlaid, and partly concealed in this and the preceding figure, by the abductor and the long flexor muscles: near its insertion it becomes divided into two processes or heads, which in fig. 1 are marked Nos. 14, 14; between these the tendon of the long flexor muscle, fig. 1, No. 15, lies as it proceeds to its insertion; the inner head of the short flexor muscle becomes inseparably connected with the abductor, and the outer with the adductor of the great toe, previously to its insertion; its posterior extremity is pointed and narrow, and is usually fixed to the inner border of the cuboid bone, also to the external cuneiform bone, and to the tendinous fibres prolonged into the foot from the posterior tibial muscle: the two processes in which it terminates in front are fixed to the base of the first bone of the great toe, and also to the sesamoid bones.

The Transverse muscle of the foot (m. transversus pedis), 12, is a narrow flat band of fleshy fibres placed beneath the digital extremities of the metatarsal bones; its external extremity is attached to the lateral ligament connecting the fifth metatarsal bone with the first bone of the little toe, and, as it inclines inwards, its fibres are attached to the plantar ligaments connecting the second and third metatarsal bones with the digital bones; its inner extremity becomes blended with the adductor pollicis.

The Short Flexor muscle of the little toe, No. 9, lies beneath the fifth metatarsal bone; its posterior extremity, No. 10, is attached to the broad part or base of the bone just named, and to the sheath of the long peroneus muscle, whilst its anterior extremity becomes narrow and tendinous previously to its insertion into the base of the first bone of the little toe.

The fourth layer of muscles in the sole of the foot consists of the interossei. Three of these are seen in fig. 3, and are marked 13, 13, 13; they are the plantar interosseous muscles. Four are seen at the upper or dorsal surface of the foot in fig. 4, where they are numbered 10, 11, 12, 13; these are the dorsal interosseous muscles:—their name is taken from their occupying the interstices between the metatarsal bones.

The Three Plantar Interosseous muscles, fig. 3, No. 13, 13, 13, are placed not between the metatarsal bones, as their name would imply; they lie rather beneath the third, fourth, and fifth metatarsal bones, each inclining somewhat inwards. The first plantar interosseous muscle is attached along the under surface and inner border of the third metatarsal bone; it ends towards its fore part in a narrow tendon, which is fixed to the inner side of the first bone of the third toe at its base, and is also connected with the tendinous expansion of the common extensor muscle. The second and third plantar interosseous muscles are connected in the same way with the metatarsal and first digital bones of the fourth and fifth toes.

The Dorsal Interosseous muscles are four in number, and lie in the spaces between the metatarsal bones; their fibres are attached to the surfaces of the two bones between which they lie, and incline forward, converging to a thin tendon placed in the middle of each, so as to constitute it a double penniform muscle; their posterior extremities are necessarily bifid, and present slight interstices, through which perforating branches pass from the plantar to the dorsal arteries of the foot. The first dorsal interosseous muscle, fig. 4, No. 11, is inserted into the base of the first digital bone of the second toe (at its inner side), and into the tendon of the extensor muscle; the second dorsal interosseous muscle is fixed in the same way at the outer side of the same toe; and the third and fourth, Nos. 12, 13, are similarly disposed of at the outer sides of the corresponding bones.

Actions.—Several anatomists name the different interosseous muscles, not from their numerical order, first, second, third, &c., but from their actions and uses. Thus, the second, third, and fourth of the dorsal set are abductors of the corresponding toes, inasmuch as they are inserted into the external side of their phalanges; but the first dorsal and the three plantar muscles are adductors, so that if all four act together, they will draw the four lesser toes to the great one. Though the power of adduction and abduction is found in the digital phalanges of the foot, it is obviously very much restricted, as compared with the hand; and when we examine the rest of the muscular apparatus in this region, we shall see sufficient reason to admit, that, though it is constructed on the same general principle as that of the hand, and made up of analogous parts, its powers are modified and adapted to the peculiar uses of the foot, which forms a basis of support for the body, as well as an instrument of propulsion in its different movements. It may be observed, that from the analogy between the general construction of the great and little toes, and the thumb and little finger, the muscles of the former have received the same names as those of the latter, as if they could perform the same uses and exert the same actions. Thus the little toe has its abductor, flexor, and adductor (the third plantar interosseous), though these motions are so extremely restricted. The size of the muscles also shows that they are intended for some more important purpose than the movement of so small a part. The nomenclature of the muscles of the great toe has also been constructed on the supposition of its admitting of abduction and adduction like the thumb. But the mode in which its metatarsal bone is articulated with the first cuneiform bone, as well as the circumstance of its digital extremity being connected with the other toes, by the transverse ligament and transverse muscle, shows that these movements are, as it were, rudimentary, and have little to do with the proper function of the part. Further, the three plantar muscles of the great toe are united so intimately together at their insertion, and for some way before it, that it is scarcely possible for them to act singly, or independently of one another; if so, they conspire in some common action, which is simply that of flexion. The bulk and power of these muscles are obviously disproportioned to the size of the part (the first phalanx) which they act on, as well as to the extent of any motions of which it admits. The same remark extends to the short muscles of the little toe, and generally to the flexors of all the toes, if a comparison be instituted between the moving powers and the things to be moved, supposing the phalanges to rank as the latter. Now, when we examine with attention the muscular apparatus of the foot, after having studied the structure and mode of adaptation of its different osseous pieces, we see abundant evidence of its being fitted to sustain strong and powerful efforts as a whole, rather than to admit of such free and varied motions amongst its parts as take place in the hand. Thus the oblique direction of the adductor and short flexor of the great toe, as well as of the little toe, enables them to draw the bones of the foot together, at the same time that they curve them downwards, and increase the arched form of the foot. These are not the only provisions for concentrating the metatarsal bones. The tendon of the peroneus longus passing across them from without inwards, and that of the tibialis posticus in the opposite direction (at least that part of it which is prolonged to the third and fourth metatarsal bones), contribute to the same effect, as does also, but in a very minor degree, the crossing of the tendons of the flexor longus pollicis and flexor communis. All these facts tend to prove, that the aggregation and fixity of the different parts of the foot have been abundantly provided for, in order to

render it a secure basis of support to the body, and that the muscular apparatus by which it is flexed and incurvated downwards, denotes it to be what we have here ventured to designate it,—a powerful instrument of propulsion in the different movements and actions of the lower extremity.

Fig. 4.—Upon the upper or convex surface of the foot, a single muscle is placed, which is here represented. It is the *Short Extensor muscle* of the toes (m. extensor brevis digitorum pedis) : it is narrow and somewhat pointed at its posterior extremity, No. 3, but gradually becomes broad and thin as its fibres are traced forwards; it ends in four narrow processes, 4, 4, 4, 4, which become prolonged by tendons towards the upper surface of the toes. The first of these tendons, No. 5, is fixed to the upper surface of the first bone of the great toe at its base ; whilst the other three, 6, 6, 6, become blended with the tendons of the long extensor as they run along the second, third, and fourth toes: the posterior extremity of this muscle is attached to the upper surface of the calcaneum, and to the ligament which connects it with the astragalus.

Actions.—The direct effect of this muscle is to straighten or extend the digital bones, and lift them from the ground ; in which it assists the long extensor muscle.

PLATE XLI.

This drawing may be considered one of a series intended to show the structure, form, and relative position of the different muscles placed at the back of the trunk, and of the neck ; they are arranged in layers lying one upon the other, and are readily distinguishable both by their size, form, and the direction of their fibres. At the right side, in this drawing, those muscles are exhibited which are brought into view by the removal of the skin and the subjacent cellular tissue. In performing the dissection, the texture of the muscles is rendered perfectly distinct by drawing the tegument so as to make it tense, and then directing the edge of the scalpel in the course of the muscular fibres.

First Layer, or Dorsal muscles.—Immediately beneath the skin there are two broad flat muscles, of which one extends from the occiput to the lower part of the back, and from the spine to the summit of the shoulder ; it is marked 5, 6, 7, and named trapezius : the other extends from the middle of the back down to the pelvis, and from the spine to the humerus ; it is marked 8, 8, 9, 10, and named, from its great breadth, the broadest (latissimus) muscle of the back. Both these muscles have been already shown in Plate XXII, and their description will be found in pp. 49, 50.

Second Layer of Dorsal muscles.—At the left side, in this drawing, the second layer of muscles is brought into view by the removal of the trapezius and the latissimus ; and those at the back part of the shoulder-joint are exposed by the removal of the deltoid muscle, which covers them, and gives to the shoulder its roundness and fullness, as may be seen at the right side, where it is marked No. 12.

The second layer of muscles consists of three, which are covered by the trapezius, and are attached to the base of the scapula, where they lie on the same plane: they are the elevator muscle of the angle of the scapula, 26 ; the small rhomboid muscle, 27 ; and the large rhomboid muscle, 28.

The Elevator muscle of the Scapula. (m. levator anguli scapulæ) is a flat narrow fasciculus, placed

PLATE XLVI.

No. 1. The back part of the occipital bone. 2, 2. The mastoid process of the temporal bone at each side. 3, 3. The transverse processes of the first cervical vertebra. 4. The middle of its posterior segment. 5. The spinous processes of the second cervical vertebra. 6. The upper oblique muscle (m. obliquus capitis superior). 7. The lower oblique muscle (m. obliquus inferior). 8. The greater straight muscle (posterior), (m. rectus capitis posticus major). 9, 9. The small straight muscle (posterior), (m. rectus capitis posticus minor), at each side of the middle line. 10. The rectus lateralis. 11. The spinous process of the seventh cervical vertebra :—in the interval between 11 and 5, (the spinous process of the second vertebra,) the interspinal muscles are seen. 12. The transversus cervicis muscle. 13. The cervical portion of the multifidus spinæ muscle. 14, 14. Its dorsal portion. 15, 15, 15, 15. The arches of the vertebræ at the right side, exposed by the removal of the multifidus spinæ muscle. 16. The lumbar portion of the multifidus spinæ muscle. 17. The lumbar portion of the longissimus dorsi muscle. 18, 18. Its points of attachment to the transverse processes of the lumbar vertebræ. 19, 19, 19, 19. Its points of attachment to the transverse processes of the dorsal vertebræ and to the tubercles of the ribs. 20, 20, 20. Its points of attachment to the ribs external to the tubercles. 22, 22, 22, 22. The costal attachments of the longissimus dorsi muscle at the right side, the rest of its substance being removed. 23, 23, 23, 23. The points of attachment of the sacro-lumbalis muscle to the angles of the ribs. 24. The crest of the ilium at each side. 25. Its posterior spinous process. 26, 26. The great sacro-sciatic ligaments. 27. The os coccygis. 28, 28. The tuberosities of the ischia.

Plate 46.

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along the side and back part of the neck: it is attached above to the posterior tubercles of three or four upper cervical vertebræ by separate tendinous points; from these the fleshy fibres descend, and form the body of the muscle. Its lower attachment is effected by means of tendinous fibres, which are fixed into that part of the base of the scapula which is included between the upper angle and the spine.

The Smaller Rhomboid muscle (m. rhomboideus minor), No. 27, is a very narrow thin fasciculus, which is separated from the larger muscle of the same name by a very slight interval, which is filled with cellular tissue: both muscles lie on the same plane, and are similar in structure and in the direction of their fibres; the only assignable difference between them being in size. The smaller rhomboid muscle is attached by its upper extremity to the spinous process of the last cervical vertebra, and to the ligament of the neck (ligamentum nuchæ), by short tendinous fibres; from these the fleshy structure inclines downwards and outwards, and becomes fixed to that part of the base of the scapula which corresponds with the triangular surface from which its spine arises.

The Greater Rhomboid muscle (m. rhomboideus major), No. 28, four or five times larger than the other, is attached by tendinous fibres to the four or five upper dorsal vertebræ, and their interspinous ligaments, by tendinous fibres; it is inserted into the base, or posterior border of the scapula, for about two-thirds of its length, occupying the interval between its spine and lower angle.

The Third Layer of muscles consists of the splenii and the posterior serrati.

The Splenius muscle (m. splenius colli et capitis), No. 24, is seen here in part of its extent, the rest being concealed by the rhomboid; the direction of its fibres is oblique, as it extends upwards and outwards from the spinous processes of the upper cervical vertebræ to the base of the skull. See Plate XLIII, No. 6. It is usually considered as presenting two portions, which are described as separate muscles, inasmuch as one is attached to the base of the skull, and the other to the cervical vertebræ: it would be as well to treat it as a two-headed muscle, for the division occurs only at its upper part. The upper part of the muscle (splenius capitis) arises from the spinous processes of the two upper dorsal vertebræ, from that of the seventh cervical, and from the ligament of the neck; its fibres incline outwards as they ascend, and become fixed to the external surface of the mastoid process, and a little farther back into the occipital bone. The lower part of the muscle, viz. splenius colli, is neither so broad nor so thick as the preceding; it arises from the spinous processes of four dorsal vertebræ, from the third to the sixth, and is inserted by separate tendinous points into the transverse processes of three or four upper cervical vertebræ. The splenii are tendinous at their points of attachment, and fleshy in the rest of their extent; they are compressed and flat; the direction of their fibres is obliquely outwards and upwards.

The posterior serrati muscles are flat and thin; they are placed at a considerable distance from one another, as one of them rests upon the lower ribs, the other upon the upper.

The Inferior Serratus muscle (m. serratus posticus inferior), No. 49, consists of fleshy and tendinous fibres, the latter forming the greater part of its extent; these will be observed to be attached to the spinous processes and the interspinous ligaments of the upper lumbar and two lower dorsal vertebræ; their direction is upwards and outwards; and the tendon terminates in four fleshy points, which are fixed to the bodies of the four lower ribs. The name given to the muscle is taken from the dentated appearance presented by its muscular attachment.

The Upper Serratus (m. serratus posticus superior) is altogether concealed by the rhomboid muscle;

PLATE XLVII.

The muscles of the perinæum are here shown, the skin and superficial fascia being removed:—the lateral parts of the pelvis and the os coccygis are so placed as to indicate the position of this region as it is seen in ordinary dissections.

No. 1, 1. The anterior superior spinous processes of the iliac bones. 2, 2. The anterior inferior spinous processes. 3, 3. The ilio-pectineal eminences. 4, 4. The bodies of the pubic bones. 5, 5. The cristæ or crests of the pubic bones. 6, 6. The corpora cavernosa penis. 7. The tube of the urethra. 8, 8. The outer surfaces of the iliac bones. 9, 9. The acetabula. 10. The obturator foramina, partly filled up by their ligaments. 11, 11. The rami of the pubic and ischial bones, forming the lateral boundaries of the perinæal space. 12, 12. The tuberosities of the ischium. 13, 13. Its spinous processes. 14. The end of the os coccygis. 15. The anal aperture. 16. The point between the anus and the bulb of the urethra, to which the fibres of some of the perinæal muscles converge. 17, 17. The accelerator urinæ muscle (m. accelerator urinæ—m. bulbeux caverneux). 18, 18. The erector penis muscle at each side (m. ischio-caverneux). 19, 19. The transverse muscle of the perinæum at each side (m. transversus perinæi — m. ischio-perineal). 20, 20. The lateral parts of the sphincter ani muscle. 21, 21. Part of the levator ani muscle at each side. 22, 22. The coccygeus muscles at each side (m. ischio-coccygeal.

it is attached to the spinous processes of the two or three upper dorsal vertebræ, and to that of the last cervical: the direction of its fibres is downwards and outwards like the preceding muscle, becoming fleshy towards its termination. It is fixed by separate points into the bodies of the second, third, and fourth ribs, a little beyond their angles. Plate XLIII, No. 18.

Actions.—The rhomboid muscles, when they take their fixed points at the spine, can act on the base of the scapula and draw it backwards, but not in a direct line, unless they conspire with the trapezius muscle; for the lower fibres of the latter ascend, whilst those of the rhomboid descend, so that their lines of direction decussate: hence, if they act together, the scapula will not be carried either upwards by the one, or downwards by the other, but directly backwards. It is in this way that we can approximate by a voluntary effort both the scapulæ, by drawing them backwards towards the spine. The elevator muscle of the angle of the scapula assists the rhomboid in one of its actions;—for instance, if the point of the shoulder be raised, the upper angle of the scapula is depressed, and the lower one is carried forwards; and when those muscles are relaxed which have effected this change, the elevator muscle restores the upper angle to its previous position, whilst the rhomboid effects the same purpose for the base and inferior angle. If the shoulder be fixed, the levator scapulæ muscle may incline the neck somewhat to its own side.

The inferior serratus muscle can act upon the lower ribs, and draw them downwards; its power, however, is very limited, owing to the shortness of its muscular fibres: still it may be classed amongst the muscles by which expiration is effected. The upper serratus muscle slightly elevates the ribs, and assists in inspiration.

The splenii muscles, when they act together, can draw the head directly backwards, in which they conspire with the trapezius and complexus. When either splenius muscle acts by itself, it inclines the head laterally, and gives it at the same time a slight rotatory motion.

The complexus muscle, in addition to its more obvious power of drawing the head backwards, and of maintaining it steadily upon the spinal column, may also, by reason of the obliquity of its fibres, assist in rotating it, but in a direction contrary to that of the splenii, as may at once be seen by inspection of their fibres.

In this drawing, a thin layer of fibrous membrane is observed a little above the inferior serratus muscle, where it is marked 48: it is so thin, that some of the tendinous fibres of the long dorsal muscles, 47, are distinguishable through it. It appears as if stretched from the spinous processes of the vertebræ to the angles of the ribs, most of its fibres taking a transverse direction from within outwards; its lower border is continuous with the edge of the inferior serratus muscle, and the upper with that of the superior serratus, so that it occupies the interval between them; thus placed, it forms a partition between the long dorsal muscles and those which we have been hitherto examining: it is usually named the "vertebral aponeurosis."

The superficial and deep muscles, which are shown in this drawing in the neighbourhood of the shoulder, have been already shown with the muscles of the shoulder and arm in Plate XIV. The deltoid muscle, its form, actions, &c. will be found indicated in pp. 20, 21; and the supra-spinatus p. 31.

PLATE XLII.

Fourth Layer of Dorsal muscles.—This drawing exhibits at one view the muscles which form the fourth layer, taken in the order of their position. Some of these are very long, and reach from the bottom of the spine to the top; and, as their most obvious use is to maintain the body in the erect position by acting on the spine, they have received the name of erector, or erectores spinæ. At the lower part of these muscles they are inseparably united, so as to form at the loins, where they correspond with the small of the back, a thick mass consisting of tendinous and fleshy fibres. They are marked at each side of the spine 13, 13: a little below the first rib, the fibres begin to separate into two bundles, between which is merely a slight groove, commencing at 12, 12; now the outer division or bundle, marked 9, is called sacro-lumbalis, and the other, No. 11, longissimus dorsi: at the left, these muscles are fully separated from one another, and their edges everted, so as to show their points of attachment. The erectores spinæ, thus united at their lower part, are attached to the spinous processes of the sacrum, and to the irregular surface outside them; also to the spinous processes of the four lower lumbar vertebræ, and to the interspinous ligaments. If the spinalis dorsi be included as part, which it ought to be, the fibres may also be said to be attached to the spines of the two upper lumbar and two lower dorsal vertebræ. They are connected, moreover, with the crest of the ilium, and

with the sacro-iliac ligament. The tendinous and fleshy mass thus attached fills up the depression at the lumbar part of the spine, and, opposite the upper lumbar vertebræ, becomes divided into three muscles, viz. sacro-lumbalis, longissimus dorsi, and spinalis dorsi.

The Sacro-lumbalis muscle is so called from its position in the loins, and its attachment to the sacrum; but as it runs upwards into the back, and is attached by tendinous points to the angles of the ribs, it may with more propriety be called sacro-costalis: it is marked 9, 9. In that part where it may be considered a distinct muscle, it will be observed to consist of tendinous and fleshy fibres, and gradually to diminish in breadth and thickness as it ascends; and that it is fixed by a series of pointed and tendinous processes into the angles of the ribs. At the left side, where the muscle is everted and drawn outwards, it will be found strengthened, and in a manner supported, by a series of tendinous and fleshy bundles, which, commencing at the angles of the ribs, pass upwards over one or two intercostal spaces in each case, and become fixed to the ribs placed above them: these constitute a set of accessory fibres to the muscle, and are commonly described under the name of "musculus accessorius ad sacro-lumbalem." The upper fasciculus of these accessory fibres is commonly attached to the transverse process of the last cervical vertebra. Connected with the upper end of the sacro-lumbalis muscle will be found a narrow fasciculus of fleshy and tendinous fibres, marked here 6, 6, which forms in a manner its cervical prolongation, and is commonly considered a separate muscle, and described under the name of "m. cervicalis ascendens:" it is attached by tendinous points to four ribs, from the third to the sixth; its fibres, as they ascend, form a narrow fleshy band, which is fixed by separate tendinous points into the transverse processes of the cervical vertebræ, from the third to the sixth inclusive.

The Long Dorsal muscle (m. longissimus dorsi) reaches from the sacrum to the top of the thorax, where it is connected with two other small muscles, by which it is prolonged to the neck and the basis of the skull. The muscle itself is marked 11, 11; its cervical prolongation, 7, 7, is called "transversalis colli;" and its cranial prolongation, 5, 5, is called "trachelo-mastoid."

Viewing the long dorsal muscle thus, with its connections and relations, we shall take each of its parts separately. The long dorsal muscle itself lies in the middle of the vertebral groove, where it is interposed between the sacro-lumbar muscle, 9, and the spinalis dorsi muscle, 14, being separated from each, though not very completely, by a groove or fissure, which lodges some loose cellular tissue; its posterior surface is smooth and even, as may be seen at the right side of the drawing; but at the left side, where it is everted, a series of tendinous processes are observed to be detached from it, and to become fixed to the transverse processes of the dorsal vertebræ at their tubercles, and also into the neighbouring parts of the ribs. The number of these processes varies in different instances from eight to eleven.

The Transverse muscle of the Neck (m. transversalis colli), 7, 7, does not properly deserve the name that it has received, as it does not express its direction, nor can it be so named from a consideration of its attachment, as several other muscles as well as it are attached to the transverse processes of the vertebræ. It is flat and thin at its middle, and irregularly pointed at its extremities, being fixed at its lower end, where it is blended with the fibres of the longissimus dorsi, to the transverse processes of four or five upper dorsal vertebræ, and by its upper extremity becomes attached, usually by four tendinous points, to the posterior tubercles of the transverse processes of the cervical vertebræ from the sixth to the second. Its position between the cervicalis ascendens, 6, and the trachelo-mastoid and complexus, 5 and 3, is here clearly indicated.

The Trachelo-mastoid muscle (m. trachelo-mastoideus), 5, extends from the transverse processes of the upper dorsal and lower cervical vertebræ upwards to the mastoid process of the occipital bone. It is flat and thin; its structure is tendinous and fleshy; and, from the manner in which its fibres are blended together, it occasionally receives the name of complexus minor. See Plate XLIV, fig. 1, No. 3.

The Spinal muscle (m. spinalis dorsi) lies close to the spinous processes, occupying the interval between them and the longissimus dorsi; it is marked 14, 14, and will be found for the most part to consist of tendinous with a mixture of fleshy fasciculi, the lower ends of which are fixed to the two upper lumbar, and two or three lower dorsal vertebræ, whilst the upper are inserted into eight or nine superior dorsal spines. When the fibres of the two spinal muscles are viewed as they are here marked, they represent a narrow lengthened ellipsis.

The Complexus muscle, 3, 3, is placed deeply at the back of the neck, and forms a considerable mass of fleshy and tendinous fibres blended together in a very intricate way, from which circumstance its name is taken. It arises from the transverse and articulating processes of four or five upper dorsal vertebræ, and four lower cervical; the inclination of each muscle is obliquely inwards as it ascends, converging towards its fellow, and becomes fixed to the depressed irregular surface between the curved

lines marked on the occipital bone. Part of the inner border of this muscle usually appears separated from the rest by a furrow or groove, so as to present the appearance of a distinct muscle, and is often described as such under the name of "biventer cervicis." It is here marked 4, 4: its lower end is attached by tendinous points to the transverse processes of the six superior dorsal vertebræ; the upper becomes blended with the complexus, and forms virtually a part of it. A fleshy fasciculus is here seen, marked 8, 8, passing upwards from the longissimus dorsi, so as to connect it with the complexus or the biventer. See Plate XLIV, fig. 2, Nos. 9, 10.

Actions.—The long dorsal and the sacro-lumbar muscles, assisted by the spinalis dorsi, which is here seen, and the multifidus spinæ, which will be shown in Plate XLVI, are the principal agents in giving fixity to the spine, and maintaining it in the erect position. They take their fixed point of attachment at the pelvic bones, and draw upon the transverse processes of the dorsal vertebræ, and on the ribs, which in effect are continuations of these, and so they can straighten or extend the spine. If the sacro-lumbalis muscle of one side act by itself, it may, by depressing the ribs, give a lateral inclination to the spinal column. When these muscles, and the prolongations which pass upwards from them to the neck and head, continue their action, they can draw the head, neck, and the whole spine backwards, so as to render it curved in that direction.

PLATE XLIII.

The fourth layer of dorsal muscles is seen here at its upper part; also the splenius, serratus posticus superior, and levator scapulæ: their description is given in the preceding pages in the comment on Plate XLII, and their names are fully stated in the references to Plate XLIII, at the foot of page 85.

PLATE XLIV.

The trachelo-mastoid muscle is shown in fig. 1, all the other parts being removed: it is marked No. 3.

In fig. 2, the complexus muscle is shown in its entire extent: it is marked 9, 10. These are described in page 95.

In figs. 3 and 4, the apparatus of small muscles placed between the two upper cervical vertebræ and the base of the skull, is drawn as they are seen from the back and from the side.—See the references at the foot of page 88.

PLATE XLVIII.

Fig. 1. A lateral view of the perinæal muscles is given here in order to show the levator ani muscle. The greater part of the ischium, with part of the os pubis, is cut away at the right side, so as to expose the extent of the levator ani muscle and its points of connection: the cut surfaces of the bones are marked 8, 9.

No. 1. The anterior superior spinous process of the ilium. 2. The curved border of the bone. 3. The outer surface of the bone. 4. The anterior inferior spinous process. 5. The body of the pubic bone. 6. Its tuberosity and crista. 7. The acetabulum. 8, 9. The surfaces of the pubic and ischial bones where they have been cut through. 10. The spinous process of the ischium. 11. The coccygeus muscle. 12. The end of the os coccygis. 13. The central point in the perinæum between the anus and the bulb of the urethra. 14. The accelerator urinæ muscle. 15. The tube of the urethra. 16. The corpus cavernosum penis at the right side. 17. The anal aperture. 18, 18. The lateral parts of the sphincter ani muscle. 19, 20, 21. The levator ani muscle, the anterior portion of which will be seen attached to the os pubis at its inner surface, the posterior to the ischium, and the middle, or intervening portion, to the pelvic fascia and obturator membrane at their union, which is here indicated by a curved white line running from before backwards.

Fig. 2. A lateral section of the pelvis is here given, in order to show the muscles of the pelvis at the inner side. The pubic symphysis, 5, is divided; and the sacrum, 9, 9, 9, is cut through from above downwards; the viscera are removed; a small part of the rectum, 18, of the vagina, 19, and of the bladder, 20, being left attached, in order to show the connexion of the levator ani muscle with them:—these parts are drawn over to the right side, and a portion of the right levator ani, 17, 17, is left connected with them.

No. 1. The inner concave surface of the ilium. 2. The anterior superior spinous process of the ilium. 3. The anterior inferior spinous process of the ilium. 4. The upper surface of the pubic bone. 5. The symphysis pubis cut through. 6. The margin of the true pelvis. 7. Part of the pelvic fascia. 8. The anterior surface of the sacrum. 9, 9, 9. The pieces of the sacrum as seen when sawed through from above downwards. 10. The canal of the sacrum. 11, 11. The spinal ridge of the sacrum. 12. The os coccygis. 13. The coccygeus muscle. 14, 15, 16. The posterior, middle, and anterior parts of the levator ani muscle. 17, 17. Part of the levator ani muscle of the right side everted. 18. The lower portion of the rectum. 19. The vagina. 20. Part of the bladder,

Plate 48.

Fig. 1.

Fig. 2.

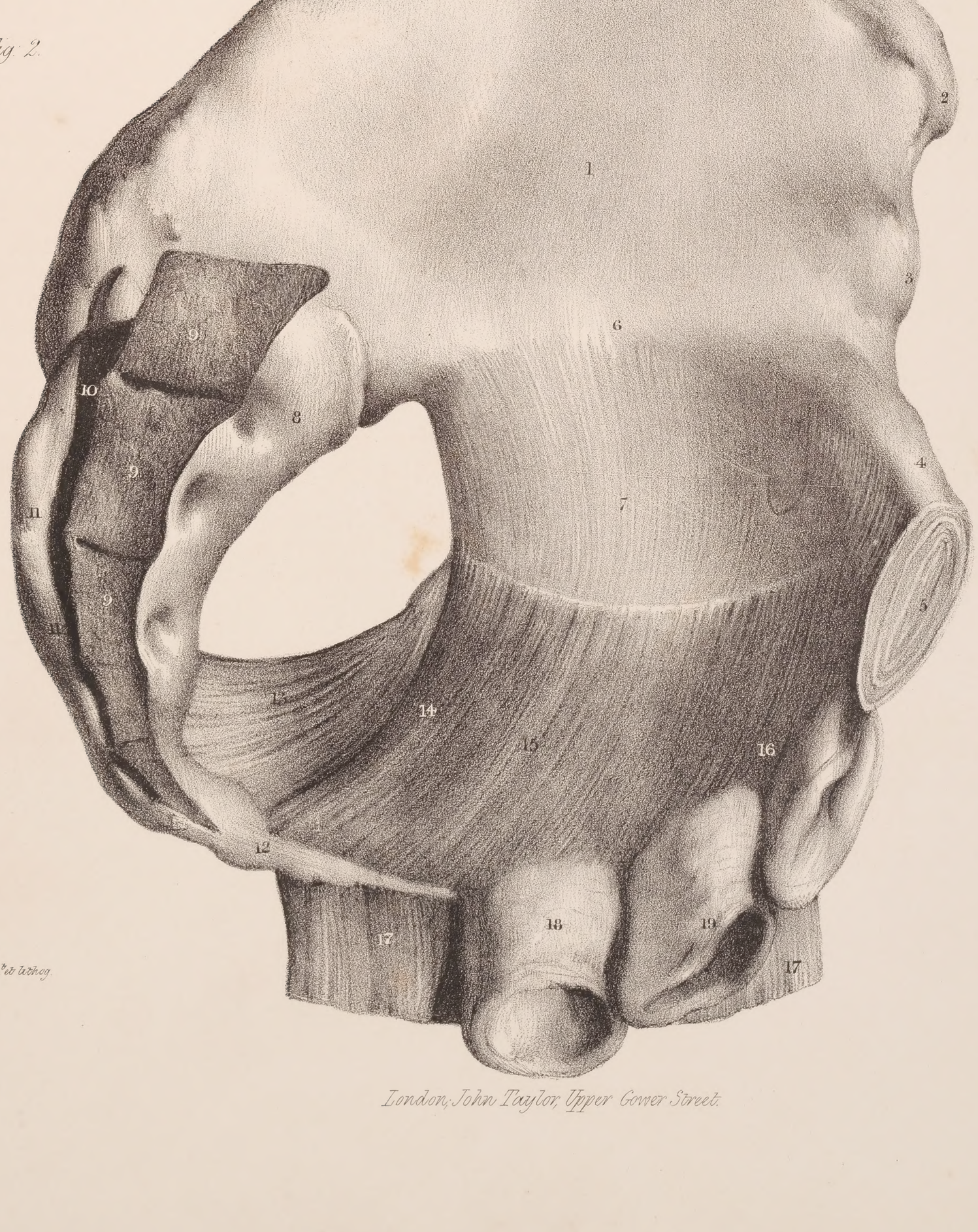

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Plate 49.

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J.W. Giles lith.

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PLATE XLV.

The muscles placed at the fore part of the spine, in the cervical region, are here seen, viz. the recti antici, the longi colli, the scaleni, intertransversales, and recti laterales. They are disposed in pairs, one being at each side of the middle line.

The Rectus Anticus major muscle, fig. 1, No. 20; fig. 2, No. 7, extends from the transverse processes of four cervical vertebræ, from the third to the sixth, upwards to the basilar process of the occipital bone: it consists of tendinous and fleshy fibres.

The Rectus Capitis Anticus minor, fig. 1, No. 21, is very short, as it extends merely from the atlas to the basilar process of the occipital bone, and is partly concealed by the rectus major.

The Rectus Lateralis muscle, 22, 22, is also very short, as it extends from the transverse process of the first cervical vertebra upwards to the occipital bone, where it is fixed to a rough ridge outside its condyloid process.

The Intertransversales are necessarily short, as they occupy the intervals between the transverse processes.

The Longi Colli muscles reach from the first cervical vertebra to the third dorsal; they lie nearly parallel the one to the other, resting upon the bodies of the vertebræ: each of them appears to consist of two portions, differing in the direction of their fibres: the upper one is marked 24 in fig. 1, and 9 in fig. 2; it is attached by a narrow tendinous process to the fore part of the atlas, and is inserted into the transverse processes of the third, fourth, and fifth cervical vertebræ,—their anterior tubercles: the lower or longer part is marked 25 in fig. 1, and 10, 11, in fig. 2; at the left side, the bundles of fibres are separated from one another as much as possible; at the right, they remain undisturbed, and are marked 12: this part of the muscle is attached to the body of the axis; also to the third and fourth cervical vertebræ, and to the transverse processes of the fourth and fifth: the general direction of the fibres is downwards, almost vertically; and, as they descend, they take points of attachment to the three lower cervical vertebræ and three upper dorsal, gradually diminishing so as to terminate in a point.

The Anterior Scalenus muscle, fig. 1, No. 27; fig. 2, No. 13, extends from the first rib upwards to the transverse processes of the cervical vertebræ, becoming fixed to their anterior tubercles from the third to the sixth.

The Posterior Scalenus muscle, fig. 1, No. 28; fig. 2, Nos. 13, 14, extends from the first and second ribs to the transverse processes of the cervical vertebræ, becoming inserted into their posterior tubercles from the second to the seventh: the fore part of this muscle, which in fig. 2 is marked 14, used to be considered as a middle scalenus muscle; and that part which lies farther back, arising from the second rib, and marked 13, was considered the posterior scalenus muscle.

Actions.—When the scaleni act together, they assist in maintaining the spine erect; in which case they take their fixed points of attachment at the ribs: if one of them acts by itself, it can incline the vertebræ to its own side; if the neck be fixed, these muscles concentrate their power upon the first ribs, and elevate them, as a preparatory step to a forcible inspiration.

The intertransversales and recti laterales incline the vertebræ laterally by drawing down the transverse processes; the anterior recti muscles incline the head forwards, and are from their position the direct antagonists of the muscles at the back of the neck: they are assisted by the longi colli.

PLATE XLVI.

The fifth layer of dorsal muscles consists of the multifidus spinæ, semi-spinalis (dorsi et colli), interspinales muscles, with the posterior recti and obliqui. These are disposed at side of the middle line of the body close to the spine.

PLATE XLIX.

In this full-length figure the superficial muscles along the fore part of the body are shown at one side, and those deeper seated at the other.

The Multifidus Spinæ muscle consists of a series of muscular and tendinous fibres, disposed in bundles, and extended obliquely from the transverse process of each of the vertebræ to the spinous process of the vertebra above it; thence it might be considered, not as a single muscle, but as an aggregate of several. Some fasciculi are found to extend over two or three spaces. The first fasciculus extends from the lateral mass of the sacrum to the spine of the fifth lumbar vertebra; this part, the lumbar portion of this muscle, is marked 16, the dorsal 14, and the cervical 15: the upper fasciculus of fibres will be found extending from the transverse process of the third cervical vertebra to the spinous process of the second.

The Interspinales muscles are short fleshy bundles placed between the spinous processes of the cervical vertebræ from the second to the seventh.

The Semi-spinalis muscle consists of a series of fleshy and tendinous fibres extended obliquely from the transverse processes of the vertebræ to the spinous processes a stage or two higher up. As they exist in the dorsal and cervical regions, they are usually considered as divisible into two muscles, viz. semi-spinalis dorsi and semi-spinalis colli.

The posterior Recti muscles are two pair at each side, one being longer and larger than the other. *The Rectus major* (plate XLVI. No. 8) extends from the spinous process of the second vertebra of the neck obliquely upwards and outwards to the posterior surface of the occipital bone.

The Rectus minor muscle (plate XLVI. No. 9) reaches from the posterior part of the arch of the first vertebra almost directly upwards to the occipital bone, a little behind the foramen magnum.

The Sacro-lumbalis muscle is shown in this drawing, No. 17; it has been already described: also the elevator muscles of the ribs. These are small muscles, No. 21, 21, 21, consisting of fleshy and tendinous fibres, which extend from the extremity of the transverse process of each vertebra downwards and outwards, to be fixed into the rib below it in the interval between its tubercle and angle.

PLATE XLVII.

The muscles of the perinæum are here shown; the skin, the superficial fascia, being removed. They may be considered as divisible into two groups,—those appertaining to the genital organs, and those connected with the termination of the alimentary canal.

The genital muscles are as follows:—

The Erector Penis muscle (ischio-cavernosus, No. 18, 18) is a thin, flat, long muscle placed on the ramus of the ischium at each side and on the crus of the penis, extending from the inner and upper part of the tuberosity of the ischium to the side of the penis. It is narrow at its extremities, but widens somewhat towards the middle. It arises from the inner border of the tuber ischii, from which its fleshy fibres proceed obliquely upwards and forwards, and become tendinous on reaching the corpus cavernosum, into whose fibrous sheath they are inserted. The inferior surface of the muscle is covered by the skin and the superficial fascia: the superior is in contact with the crus and body of the penis, whilst between its inner margin and the accelerator muscle a groove exists, in which the superficial perinæal vessels are lodged.

The Accelerator Urinæ muscle (bulbo-cavernosus, No. 17, 17) is so disposed as to surround the bulbous part of the urethra. We may consider it as a single muscle consisting of two symmetrical halves, united so as to form a tube surrounding a part of the urethra, and connected, anteriorly, by two diverging processes, with the corpora cavernosa, and posteriorly, at the central point of the perinæum, No. 16, with the sphincter ani and the transverse muscles, whilst its inferior fibres are extended obliquely outwards at each side to the rami of the ossa pubis. Its analogy with the constrictor vaginæ would lead us to consider it in this way. In conformity with usage, however, we shall describe each lateral half as a separate muscle.

The fibres of the accelerator muscle, forming a thin plane, are blended with those of the corresponding muscle along the middle line, beneath the bulb of the urethra. Their junction extends forwards for three quarters of an inch from the central point above referred to. The fibres from this line of origin proceed in three different directions: the inferior set pass obliquely outwards, and are attached to the angle of union formed by the deep perinæal fascia with the ramus of the pubes; the anterior set incline upwards and outwards, to be inserted into the corpus cavernosum; whilst the intervening or middle fibres coil round the canal of the urethra, and become tendinous on reaching its upper surface, upon which they unite with those of the corresponding muscle, thus forming a tube.

If an incision be made over the bulb, so as to cut through the fibres of the muscle, and if one half be then carefully reflected outwards, its points of attachment will be readily seen; after which, if the urethra be cut across and reflected downwards, the union of the middle part of the muscle on its upper surface will be brought into view.

The Transversus Perinæi muscle (ischio-perinæalis, No. 19, 19) is a narrow fleshy fasciculus, which inclines forwards and inwards across the perinæum, being extended from the inner border of the tuber ischii at its junction with the ramus, to a point midway between the margin of the anus and the bulb of the urethra. The muscles of the opposite sides arise from the inner margin of the tuberosities and the rami of the ischia, and proceed with an inclination forwards, to the point just indicated, where they are blended with the sphincter ani and acceleratores urinæ. Another muscle of this name is occasionally found at each side, lying anterior to the one here described, and called *transversus perinæi alter;* the fibres of the latter are usually thin and pale.

The anal muscles are as follow :—

The external Sphincter Ani (coccygeo-analis, No. 20) is a flat elliptic muscle, placed immediately beneath the skin surrounding the margin of the anus, No. 15. It is attached posteriorly to the coccyx, 14, by a narrow fasciculus of tendinous fibres, and anteriorly becomes blended, about midway between the anus and the bulb, through the medium of a common fibrous point, with the transversi and acceleratores muscles, whilst the intervening part is disposed like orbicular muscles elsewhere, being composed of fleshy fibres curving round the intestine, and united by commissures before and behind it. One surface of the muscle is covered by the skin, the other rests on the internal sphincter, and on some cellular tissue which separates it from the levator ani.

The internal Sphincter Ani is a flat muscular ring, surrounding the anal extremity of the rectum; it is about four or five lines in breadth, and two thick. It obviously consists of the circular fibres of the intestine much more developed than elsewhere, and projecting lower down than the longitudinal fibres.

The Levatores Ani are two thin broad muscles, so placed at the outlet of the pelvis as to assist in closing it at the same time that they support the contained organs. They are seen only in part in plate XLVII. No. 21, 21; but they are brought fully into view in plate XLVIII.—viz. that of the right side in fig. 1, Nos. 19, 20, 21, and that of the left side in fig. 2, Nos. 14, 15, 16. Each levator ani is attached at its fore part to the os pubis near its symphysis, and immediately above its arch; posteriorly, to the spine of the ischium, and along the intervening space to the angle formed by the union of the obturator and pelvic fasciæ. From this extensive origin the fibres proceed downwards and inwards, the posterior set being fixed to the side of the coccyx; those next them in order unite by a raphé with the corresponding muscle, in the interval between the coccyx and the margin of the anus; the middle fibres are inserted into the extremity of the rectum, becoming connected with those of the internal sphincter, and the anterior ones pass on the side of the prostate, some of them uniting with those of the corresponding muscle beneath the membranous part of the urethra. In the female, the fibres of this muscle, previously to reaching the rectum, descend by the vagina, and become intimately connected with it.

The Coccygeus muscle (ischio-coccygeus, No. 22, 22; also plate XLVIII. fig. 1, No. 11; fig. 2, No. 13,) is placed deeply at the back part of the outlet of the pelvis, which it assists to close, by being stretched from the spinous process of the ischium to the side of the sacrum and coccyx. It is made up of tendinous and fleshy fibres, forming a flat triangular plane, the apex of which is attached to the spine of the ischium, and the base to the border of the coccyx and lower part of the sacrum. The internal, or pelvic surface, supports the rectum; the external is covered by the sacro-sciatic ligaments.

Actions.—The transverse muscles conspire to fix the common point of attachment of the perinæal muscles, and so increase their power. The action of the sphincter ani is sufficiently obvious. The accelerator muscle surrounds the bulbous part of the urethra, and, having points of attachment before and behind, is enabled forcibly to propel any fluid that may be lodged within the canal in that situation. The levator ani, in position and direction, is opposed to the diaphragm; and as the latter forces down the intestines by its descent, particularly in expulsive efforts, the levator, as its name implies, can elevate at least the lower part of the intestinal canal.

PLATE XLVIII.

The levator ani and coccygeus muscles are here brought more fully into view than in plate XLVII. The levator is marked in fig. 1, 19, 20, 21; and in fig. 2, 14, 15, 16. The coccygeus in fig. 1 is marked 11, and in fig. 2, 13. Their description is given in the remarks on the preceding plate.

PLATE L.

The muscles situated at the posterior aspect of the body are here shown at full length: the superficial layer at one side, and those deeper seated at the other.

Plate 50.

George Childs lith.

Walsh del.

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Dislocations of the Patella.—This bone may be thrown either outwards or inwards off the pulley-like surface on which it rests. It may also be drawn upwards if the ligamentum patellæ be ruptured. The dislocation outwards is the most frequent. It may follow the application of force, or a blow, tending directly to press the bone outwards; or be the result of muscular effort during a twisting or wrenching movement in the joint, particularly in persons in whom the knees incline much inwards. The pain felt, the alteration in the form of the joint, the impossibility of effort or of walking, at once indicate the nature of the accident. The leg is in a state of extension; a tumour is perceived at the outer side of the femoral condyle: the tendon of the rectus muscle, and the ligamentum patellæ incline outwards, being drawn to the point where the patella is placed: the inner border of the pulley at the articular surface of the femur can be distinctly felt unless the tumefaction be very considerable; so can the inner edge of the patella, which from its position upon the external condyle turned somewhat forwards, whilst the anterior surface of the bone has an inclination outwards. In the dislocation inwards, the position of the limb, and other accompanying circumstances, are nearly the same as in the preceding case, except that the bone lies over the inner condyle. Another mode of displacement of the patella has occurred in a few instances: it has become inverted, so that one of its edges projected directly forwards under the skin, whilst the other rested perpendicularly upon the middle of the trochlea, or pulley-like surface of the femur. The reduction of these accidents should be effected as soon as possible. To relax all the muscles put into a state of action, extension is essential. For this purpose, having placed the patient in the recumbent position, the leg should be drawn forwards or extended as much as possible, by which the triceps extensor will be relaxed, and all tension of the rectus muscle can be removed by raising the body a little, so as to bring the pelvis somewhat forwards upon the thigh. When relaxation of the muscles is thus effected, the bone should be pressed steadily towards the articular surface from which it has been displaced, taking care not to force it directly against the projecting margin of the condyle. To avoid this, the edge of the patella which is farthest from the articulation may be depressed a little, so as to raise the other over the border of the condyle.

Dislocations of the Knee-joint.—The tibia may be thrown inwards or outwards; but these lateral displacements are almost always incomplete, the extent of the articulating surfaces being sufficient to prevent their total separation. Again, the tibia may be forced backwards or forwards. In the dislocation inwards, the tuberosity of the tibia forms a considerable projection at the inner side of the joint, the inner condyle of the femur corresponds with the external articular surface of the tibia, and its semi-lunar cartilage: at the outer side of the joint there is a depression beneath the external condyle of the femur; and at the inner, a similar depression above the projecting tuberosity of the tibia; the patella and its ligament are drawn somewhat inwards; all which circumstances give a great degree of deformity to the joint. In the dislocation outwards, the relative position of the bones, and of their projecting parts, will be the opposite of that just stated.

The dislocation of the tibia backwards is of rare occurrence. It has been produced by a fall from a height, during which the knee (the joint being in the bent position) was arrested by some projecting body, whilst the femur was pressed downwards and backwards by the weight of the body, and the force of the descent. In this way the tibia was forced back into the popliteal space, and the extremity of the femur formed a considerable projection in front. The leg under such circumstances, may be in the state of forced and permanent flexion. In a case noticed by Sir A. Cooper, the limb was found shortened, the condyles of the femur formed a considerable projection, the ligament of the patella was drawn back, and as it were sunk into a depression, and the leg, instead of being flexed, was rather bent forwards. The dislocation forwards can be produced only by extreme violence, sufficient to lacerate the posterior and crucial ligaments, and, perhaps, one or both lateral ligaments. It may be produced by the passing of a wheel over the lower part of the thigh, so as to force it backwards, the leg being fixed and supported so that it cannot give way at the same time.

These accidents are easily reduced, there being little resistance to be overcome: if moderate extension and counter-extension be kept up, the tibia can be pressed into its position without much force.

Dislocations of the Ankle-joint.—Three modes of displacement are liable to occur in this articulation, as the bones of the leg may be thrown off the astragalus, inwards, outwards, or forwards. In the first case, the internal malleolus is forced inwards so as to rest upon the inner side of the astragalus, where it forms a considerable projection under the integument; the foot is pressed outwards and somewhat everted, so that its inner border rests upon the ground; it is also easily moved in different directions. The fibula will be found fractured about three inches above the external ankle,

at which point a crepitus is heard on slight motion, and a depression is perceived. In the second form of dislocation, the external malleolus is forced outwards and forms a considerable projection, the internal one is fractured near its summit; the foot is pressed inwards, and so altered in its direction that its outer border touches the ground. In the third form of dislocation, the tibia is forced forwards so as to rest on the navicular and internal cuneiform bones; the fibula is broken about two inches and a half above the joint, its lower end being retained in its position by the ligaments, whilst the upper piece is carried forward with the tibia. The foot appears shortened, the heel much more prominent than usual, and raised so that the toes are pointed towards the ground. A partial dislocation of the tibia has been known to occur in a few instances. The lower end of the bone rests partly on the astragalus, partly on the os naviculare: the fibula is broken; the foot appears a little shortened, the heel raised, and the toes pointed downwards. In all these cases the principal resistance to reduction is given by the muscles of the calf of the leg; hence they must be relaxed as much as possible. If the patient be placed on his back on a mattress, and the leg be bent to a right angle with the thigh, the latter being raised and supported, extension may be made by drawing on the foot, and counter-extension by an assistant holding steadily the lower part of the thigh.

In addition to the muscles of the perinæum described page 98, we have to notice the following:

The Compressor muscle (urethræ, Wilson; compressor prostatæ, Sœmm.) is a narrow fasciculus that arises close by the pubic symphysis, immediately before the anterior fibres of the levator ani, and from which it is merely separated by a small vein and a little cellular tissue. The muscle descends close to its fellow of the opposite side, and beneath the membranous part of the urethra, both of them having become tendinous, unite so as to support it in a sling. Many persons consider this as but a part of the levator ani.

The Compressor muscle (venæ dorsalis penis) is a thin fasciculus, composed partly of tendinous, partly of fleshy fibres, placed beneath the pubic arch, and above the root of the penis. Its fleshy fibres are attached to the inner margin of the ramus of the os pubis, immediately above those of the erector penis; from this point the fibres ascend, at the same time inclining forwards and inwards, and end in a thin tendon, which unites with that of its fellow of the opposite side, at the median line, just over the dorsal vein. The perinæal muscles in the female correspond so nearly with those of the male in their number, general conformation, and attachments, that it is unnecessary to treat particularly of more than two of them.

The Erector Clitoridis muscle (depressor, Meckel) resembles the diminutive of the erector penis; it arises from the ramus of the pubis, and is inserted into the body of the clitoris.

The Constrictor Vaginæ muscle (perinæo-clitorius) resembles an orbicular muscle, being composed of two narrow fasciculi, united before and behind the vagina by two commissures, and leaving between them an elliptic interval corresponding with its circumference. The two muscles of this name may be said to arise posteriorly at a point which is common to them, to the sphincter ani and transversi muscles; after diverging to enclose the vagina, they unite in front of it into a tendinous process, which connects them to the corpus clitoridis.

Amongst the deep-seated muscles of the back already referred to, the following require to be noticed.

The Cervicalis Ascendens muscle (plate XLII. No. 6; plate XLIII. No. 15) is prolonged upwards into the neck from the sacro-lumbalis (m. cervicalis ascendens; cervicalis descendens); it arises from the angles of the sixth, fifth, fourth, and third ribs, by a series of tendinous fasciculi, which are blended with the fibres of the sacro-lumbalis. These gradually unite to form a thin, short, muscular band, which extends along the transverse processes of the sixth, fifth, fourth, and third cervical vertebræ, into which it is inserted by so many separate digitations or points.

The Obliquus Capitis Inferior muscle (axo-atloideus; plate XLIV. fig. 3, No. 9; fig. 4, No. 13; plate XLVI. No. 7) is placed obliquely between the first two cervical vertebræ. It arises from the spinous process of the axis, between the origin of the rectus posticus major and the insertion of the semi-spinalis colli, and is inserted into the extremity of the transverse process of the atlas.

The Obliquus Capitis Superior muscle (atlo-post-mastoideus; plate XLIV. fig. 3, No. 8; fig. 4, No. 10; plate XLVI. No. 6) extends from the atlas to the lateral and inferior part of the base of the skull. It arises from the extremity of the transverse process of the first cervical vertebra, inclines from thence obliquely upwards and inwards, expanding somewhat as it ascends, and is inserted, close behind the mastoid process, into the interval between the curved lines of the occipital bone. These two muscles are covered by the complexus, and correspond, the one with the first inter-vertebral space, the other with that between the atlas and occiput.

The Supra-spinales muscles.—Some fasciculi of muscular fibres are found extended between the summits of the spinous processes, which are named as above: in position and attachment they are analogous to the recti postici.

The several muscles of the tongue, of the os hyoides, and the soft palate, though forming separate groups, are yet combined in the function of deglutition and in the modulation of the voice. Two of these are given in this plate LI. viz. the palato-glossus and the palato-pharyngeus; the rest are shown in plates V. and VI. The muscles of the tongue and os hyoides consist of several pairs as follow.

The Mylo-hyoideus muscle (plate 4, No. 22; plate VI. fig. 1, No. 17; fig. 4, Nos. 4, 4; plate X. fig. 1, No. 15) forms a flat plane of fleshy fibres extending from the lower jaw to the os hyoides. It *arises* from the mylo-hyoid ridge, along the inner surface of the lower jaw. The posterior fibres incline obliquely forwards as they descend to be inserted into the body of the os hyoides; the rest proceed, with different degrees of obliquity, to join at an angle with those of the corresponding muscle, forming, with them, a sort of raphé along the middle line, from the symphysis of the jaw to the os hyoides. The external surface of the mylo-hyoideus (which in the erect position of the head is inferior) is covered by the digastricus and sub-maxillary gland; the internal, which looks upwards and inwards to the mouth, conceals the genio-hyoideus and part of the hyo-glossus and stylo-glossus, and also the gustatory nerve; its posterior border alone is free and unattached, and behind it the duct of the submaxillary gland turns in its passage to the mouth.

The two muscles of this name, by their junction in front, and by the inclination of the plane which they form, support the mucous membrane of the mouth and the tongue, constituting a muscular floor for that cavity.

The Genio-hyoideus muscle (plate VI. fig. 2, No. 27; plate X. fig 1, No. 16) is a narrow, rounded muscle, concealed by the preceding, and lying close to the median line. It *arises* from the inside of the symphysis of the chin (its inferior sub-mental tubercle), and thence descends (separated from the corresponding muscle only by a narrow cellular interval), to be inserted into the body of the os hyoides. This pair of muscles lies between the mylo-hyoideus and the lower or free border of the genio-hyo-glossus.

The Hyo-glossus muscle (plate VI. fig. 2, No. 24; plate VIII. fig. 5, No. 17) is a flat, thin band of muscular fibres, extended upwards upon the side of the tongue from the lateral portion of the os hyoides. It *arises* from the great cornu of the os hyoides its whole length, and from part of the body of that bone. From this the muscular fibres incline upwards and outwards, to be inserted into the side of the tongue, where they expand, becoming blended with its substance: the direction of this muscle is almost vertically upwards, and that of the stylo-glossus horizontally forwards, so that they decussate upon the side of the tongue.

The Genio-hyo-glossus muscle (plate VI. fig. 2, No. 26; plate VIII. fig. 5, No. 18; fig. 6, No. 8) is so called from its triple connexion with the chin, os hyoides, and tongue. The muscle forms a flat, triangular plane of fleshy fibres, placed vertically in the median line, the apex of the triangle being represented by its origin from the inside of the symphysis of the lower jaw, the base by its insertion along the whole length of the tongue from its point to its root, for the fibres spread out radiating like the ribs of a fan; one of the sides (the lower one) corresponds with the border which extends from the symphysis to the os hyoides, the other (upper and anterior) with the frænum linguæ. Its inner surface is in contact with the corresponding muscle, the external being covered by those last described. It *arises*, by a short, pointed tendon, from the superior sub-mental tubercle on the inside of the symphysis of the chin. To this the fleshy fibres succeed, and diverge from one another; the inferior ones passing down to the os hyoides, the anterior forwards to the tip of the tongue, and all the rest proceeding with different degrees of obliquity to the under surface of the tongue, with which they are blended in its entire length from base to apex. The internal surface of the muscle is in contact with that of its fellow, from which it is at first separated slightly by some cellular tissue, but both become closely adherent towards their termination. The external surface is in contact with the lingualis, hyo-glossus, and stylo-glossus, the sub-lingual gland, and lingual artery.

The Stylo-glossus muscle (plate VI. fig. 2, No. 18; plate VIII. fig. 5, No. 12; fig. 6, No. 5) lies along the side of the tongue, to which it is extended from the styloid process. Its direction is forwards and a little downwards, so that it becomes nearly horizontal. It *arises* from the styloid process near its point, and from the stylo-maxillary ligament, to which the greater number of its fibres are attached by a thin aponeurosis, and is inserted along the side of the tongue, its fibres expanding somewhat as they become blended with its substance; they overlay those of the hyo-glossus muscle.

The Lingualis muscle (plate VIII. fig. 6, No. 3, 7) is a thin, narrow band of fleshy fibres, extended along the under surface of the tongue in its entire length. It lies close to the outer side of the genio-

hyo-glossus, between it and the hyo-glossus; one extremity of its fibres is connected to the os hyoides, and the other prolonged to the tip of the tongue, being blended inseparably with its substance.

Actions.—The muscles that pass from the jaw-bone to the os hyoides are ordinarily employed in elevating the latter, and with it the base of the tongue, more particularly in deglutition. The genio-hyo-glossi, by means of their posterior and inferior fibres, can draw up the os hyoides, at the same time bringing it and the base of the tongue forwards, so as to make its apex protrude beyond the mouth. The anterior fibres will, subsequently, act in retracting the tongue within the mouth. The mylo-hyoidei may be compared to a movable floor or bed, which closes in the inferior and anterior part of the mouth, at the same time serving to sustain the body of the tongue. The linguales resemble retractor muscles: they shorten the tongue, and draw its apex downwards, so as to make its dorsum convex.

The muscles of the soft palate consist of the following pairs; two are given here, the rest in preceding plates.

The Elevator muscle of the Palate (m. levator palati; peri-staphylinus internus, περι, about or near, σταφυλη, the uvula; plate V. fig. 3, No. 17; fig. 4, No. 26; plate VI. fig. 3, No. 10;) is a long, thin, flat muscle, placed at the posterior surface of the soft palate under cover of the mucous membrane, which arises from the extremity of the petrous portion of the temporal bone, before the orifice of the carotid canal, and from the cartilaginous part of the Eustachian tube. The two muscles converge, as they descend, to become blended at the middle of the soft palate with the other muscles, viz. the levator palati of the opposite side, the azygos uvulæ, and the tendon of the circumflexus palati.

The Tensor muscle of the Palate (m. circumflexus; vel tensor palati, peri-staphylinus externus; plate V. fig. 3, No. 18; fig. 4, No. 27; plate VI. fig. 3, No. 11;) presents two portions which differ in their direction and relations. The muscle arises from the small fossa (navicularis) at the root of the internal pterygoid plate of the sphenoid bone, also from the anterior surface of the cartilage of the Eustachian tube. From these points it descends perpendicularly between the internal pterygoid muscle and the osseous lamella of the same name, and ends in a tendon, which winds round the hamular process; there it inclines inwards and expands at the same time into a broad aponeurosis, the fibres of which are inserted into the transverse ridge on the under surface of the palate process of the palate bone, and on reaching the middle line they unite with the aponeurosis of the corresponding muscle of the opposite side.

The Azygos uvulæ muscle (palato-staphylinus; plate V. fig. 3, No. 16; plate VI. fig. 3, No. 13;) was so called from its having been supposed to be a single muscle; but there are really two thin fasciculi separated by a slight cellular interval above, which usually unite towards the lower part. Each arises from the pointed process (spine) of the palate plate, and descends vertically, becoming blended with the other structures in the uvula.

The Palato-glossus muscle (constrictor isthmi faucium; plate V. fig. 4, No. 25; plate LI. fig. 10, No. 6;) inclines from the uvula forwards and outwards to the side of the tongue, where it may be considered as inserted. It is merely covered by the mucous membrane, which it renders prominent, so as to form the anterior arch of the palate.

The Palato-pharyngeus muscle (plate V. fig. 3, No. 19; fig. 4, No. 20; plate LI. fig. 10, No. 7) arches downwards and backwards, so as to leave an angular interval between it and the preceding. It commences at the uvula, and descends into the pharynx, being intimately connected with its muscles, and is prolonged as far as the cornu of the thyroid cartilage. It forms the posterior arch or pillar of the velum palati.

Actions.—When the mass of food is carried back towards the fauces, the soft palate is raised nearly to a level with the hard one, and not only serves to prevent the ingesta from passing into the nares, but also, by the contraction of its two arched muscles, assists in pressing them down into the pharynx. The circumflex muscles stretch the palate from side to side, and render it tense, whilst the proper elevators raise it up, and then the palato-glossi and palato-pharyngei, taking their fixed points below, are enabled, by depressing the palate, to force down the food into the cavity ready to receive it.

The stylo-hyoideus muscle and the stylo-pharyngeus may be considered here in connexion with the preceding group.

The Stylo-hyoideus muscle (plate VI. fig. 2, No. 19; plate VIII. fig. 5, No. 13) lies close to the posterior belly of the digastricus muscle, being a little behind and beneath it. It *arises* from the middle of the external surface of the styloid process of the temporal bone, from which it inclines downwards and forwards, to be inserted into the os hyoides at the union of its great cornu with the body. Its fibres are divided into two fasciculi near its insertion, for the transmission of the tendon of the digastricus. Its upper part lies deeply, being covered by the sterno-mastoid and digastricus

Plate 51.

Fig.1.

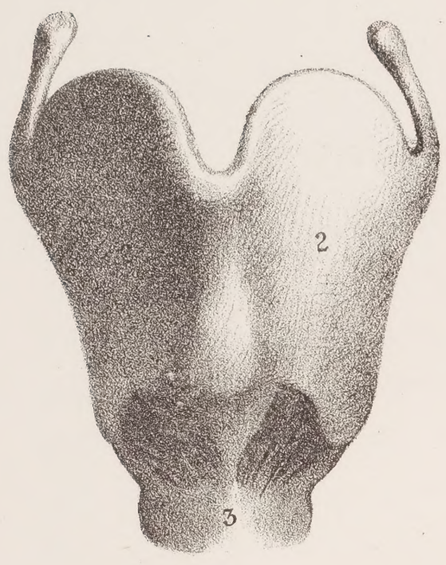


Fig.2.

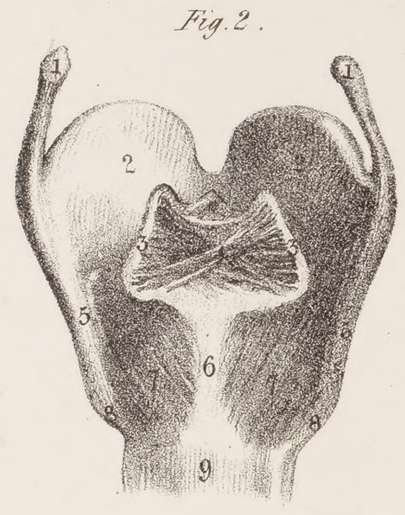


Fig.3.

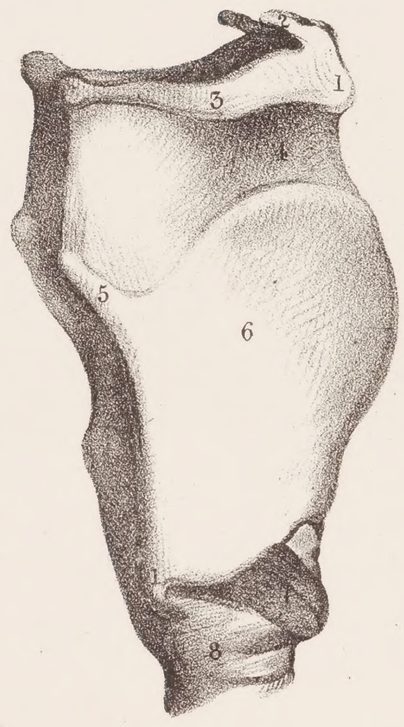


Fig.4.

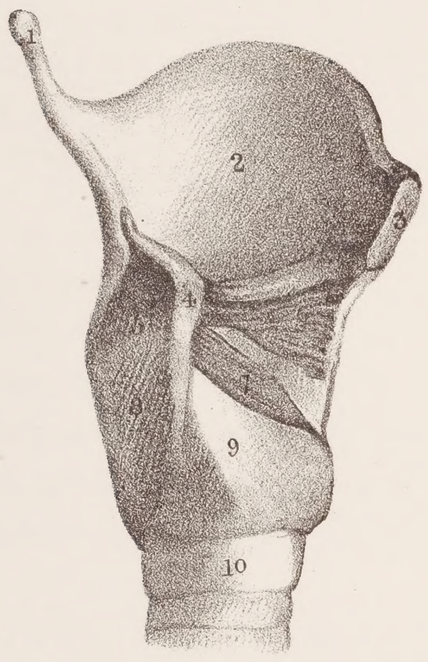


Fig.5.

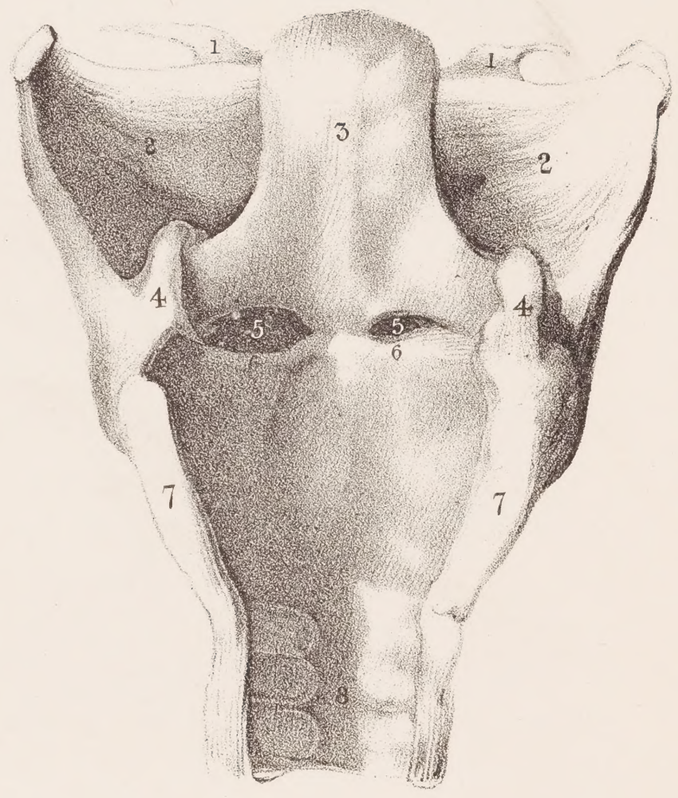


Fig.6.

Fig. 7.

Fig.10.

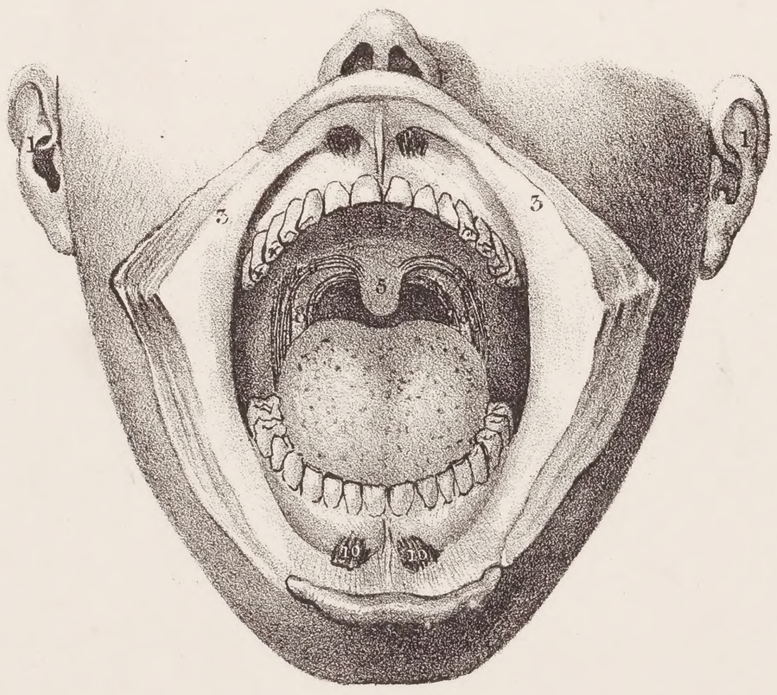
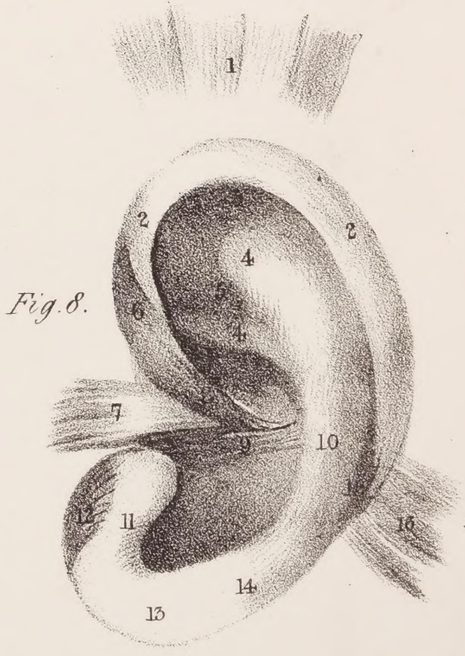


Fig.9.

Fig.8.



Wm Fairland lith.

London, Taylor & Walton, Upper Gower St.

J. Walsh del.

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muscles, and by part of the parotid gland: the middle crosses the carotid arteries; the insertion is comparatively superficial.

The Stylo-pharyngeus muscle (plate V. figs. 1, and 2, No. 13; plate VI. fig. 2, No. 20) is larger and longer than the other styloid muscles, and also more deeply seated; it extends from the styloid process downwards, along the side of the pharynx. It *arises* from the inner surface of the styloid process, near its root, from which it proceeds, downwards and inwards, to the side of the pharynx, where it passes under cover of the middle constrictor muscle, with which its fibres contract some connexion, but are finally prolonged to the posterior border of the thyroid cartilage, into which they are inserted. The external surface of the muscle is, in the upper part of its extent, in contact with the styloid process and stylo-hyoideus muscle and external carotid artery; in the lower, with the middle constrictor of the pharynx; the internal rests on the internal carotid artery and jugular vein; but, in the lower part of its extent, it is in contact with the mucous membrane of the pharynx.

Actions.—The stylo-hyoidei and stylo-pharyngei conspire in elevating the base of the tongue and the bag of the pharynx at the moment when deglutition is taking place, the latter pair of muscles tending at the same time to widen the pharynx. The peculiar mechanism of the digastric muscles enables them to contribute to the elevation of the os hyoides also; for when the two fleshy parts contract together they come nearly into a straight line, and thereby draw up the bone just named, by means of the connexion of the middle tendon of the muscle with its cornu. As a preparatory measure, the mouth must be closed, and the lower jaw fixed, which is one of the first steps in the process of deglutition. If the os hyoides be kept down by the sterno-hyoideus, the anterior belly of the digastricus will serve to depress the lower jaw. The stylo-glossi muscles retract the tongue; they also act on its margins, and elevate them: if the genio-hyo-glossi come into action at the same time, and draw down its raphé, or middle line, its upper surface will be converted into a groove, fitted to convey from before backwards to the fauces any substance required to be swallowed.

PLATE LI.

We usually group together the several pairs of small muscles, which move the cartilages of the larynx, and are thereby concerned in the production of voice.

The Crico-thyroid muscle (m. crico-thyroideus; fig. 1, Nos. 4, 4; fig. 3, No. 7), is a short muscle, which, as its name implies, is attached to the cricoid and thyroid cartilages, its direction being obliquely upwards and outwards, diverging from its fellow of the opposite side. By this arrangement the crico-thyroid membrane is left uncovered, except by the skin and fascia, where it is to be punctured in the operation of laryngotomy. This muscle is concealed by the sterno-hyoideus and sterno-thyroideus.

The posterior Crico-arytænoid muscles (m. crico-arytænoidei postici; fig. 2, Nos. 7, 7).—These rest posteriorly on the broadest part of the cricoid cartilage, covering by their origin the whole of it, except the middle perpendicular line. Their fibres converge, as they proceed upward and outwards, to be inserted by a narrow process into the bases of the arytænoid cartilages by their external borders. They are merely covered by the mucous membrane.

The lateral Crico-arytænoid muscles (m. crico-arytænoidei laterales; fig. 4, No. 7) are extended obliquely backwards and upwards, from the upper border of the cricoid cartilage on each side, to the base of the arytænoid cartilage. They lie in the interval between the alæ of the thyroid cartilage and the glottis, concealed by the lining membrane.

The Thyro-arytænoid muscles (m. thyro-arytænoidei; fig. 4, No. 6) are placed immediately above the preceding, and are united with them at the point of insertion; they are stretched from before backwards, between the inner surface of the thyroid cartilage at its angle, and the base of the arytænoid cartilages at their anterior border. They lie parallel with the rima of the glottis.

The Thyro-epiglottic muscles.—Some muscular fibres may also be traced from near the origin of the preceding, which ascend to the margin of the epiglottis. These are described by some anatomists as thyro-epiglottidæi, or depressores epiglottidis; but it may be observed, that the closure of the aperture by means of the epiglottis, is effected by the ascent of the whole larynx, by which the rima is drawn as it were under cover of its operculum, and not by the descent of the latter upon it.

The Arytæno-epiglottic muscles.—Some muscular fibres are also occasionally found in the folds of

mucous membrane stretched between the arytænoid cartilages and the epiglottis. These have been named arytæno-epiglottidæi.

The Arytænoid muscle (m. arytænoideus; fig. 2, No. 4) consists of oblique and transverse fibres intimately blended together, and laid upon the posterior concave surface of the arytænoid cartilages. Albinus and Winslow, from a consideration of the difference in the direction of its fibres, divided the muscle into three, viz. two oblique, and one transverse; but as all conspire in their actions, and are inseparably connected together, most modern anatomists describe them as a single muscle. The oblique fibres pass from the base of one cartilage towards the apex of the other, crossing in the middle. The transverse fibres pass from one border to the other, and are partly covered by the oblique.

Actions.—The arytænoideus muscle contracts the base or widest part of the rima, rendering it an elongated chink, and is therefore the direct antagonist of the posterior crico-arytænoid muscles, which draw the basis of the cartilages outwards and widen the interval between them. These cartilages are, on the contrary, drawn forwards (and the antero-posterior extent of the aperture thereby diminished) by the lateral muscles, which pass to them from the cricoid and thyroid cartilages. It may easily be shown that the fibres of the thyro-arytænoid muscles are not merely stretched from before backwards, between the cartilages, but that some of them are attached at different points to the chordæ vocales, and so may act as stops on a musical string, limiting the extent of the part which vibrates at a given moment, and thereby modifying the sound.

Two small muscles of the lips are here indicated.

The Depressor muscle of the upper lip and nose (depressor labii superioris alæque nasi; m. myrtiformis; fig. 10, Nos. 9, 9) is a small flat muscle, extended from a slight pit (myrtiform fossa) near the alveolar border of the upper jaw, to the lateral cartilage of the nose; it lies between the mucous membrane and the muscular structure of the lip, with which its fibres are closely connected; this double connexion enables it to depress the lip as well as the nasal cartilage.

The Elevator muscle of the lower lip (m. levator labii inferioris; fig. 10, No. 10) arises from a slight pit a little below the alveolar border of the lower jaw, near the symphysis. This pair of muscles occupies the interval between the two depressors of the lower lip. They are small, short, and somewhat tapering, being narrow at their point of origin, from which they increase in breadth towards their insertion. They incline downwards and a little forwards to reach the tegument of the chin, into which they are inserted. The names of most of the muscles included in the three foregoing groups sufficiently indicate their actions.

The external muscles of the ear may be divided into two groups, viz. those which move the pinna as a whole, and those which can act only on particular parts of it. The first group consisting of the superior, the posterior, and anterior muscles, will be found in plate IX. fig. 1, Nos. 3, 4, 5; also in this plate, fig. 8, Nos. 1, 7, 16.

The Superior muscle (m. superior auris, attollens aurem, temporo-auricularis; fig. 8, No. 1; plate IX. fig. 1, No. 3) is the largest. It arises from the temporal aponeurosis, where it expands on the side of the head, its fibres, though delicate, being broad and radiated. The muscle ends in a compressed tendon, which is inserted into the upper and anterior part of the cartilage of the ear.

The Posterior muscle (m. posterior auris, retrahens aurem, mastoido-auricularis; fig. 8, No. 16; plate IX. fig. 1, No. 5) consists of two or three thin fasciculi, ranged one over the other; they arise from the mastoid process by short aponeurotic fibres, and are inserted into the back part of the concha.

The Anterior muscle (m. anterior auris, attrahens aurem, zygomato-auricularis; fig. 8, No. 7) is a narrow, fleshy, and tendinous fasciculus, which is attached to the temporal fascia above the zygoma, and passes backwards, to be inserted into the fore part of the helix.

The second group of muscles, viz. those which act on separate parts of the pinna, are the following:

Musculus major helicis (fig. 8, No. 6) arises just above the tragus, runs upwards upon the helix, and terminates where it is about to curve backwards.

m. Minor helicis (fig. 8, No. 8) commences in the concha close to the commencement of the helix, inclines upwards and forwards, and is lost upon the rim of the helix.

m. Anti-tragicus (fig. 8, No. 15) commences at the posterior surface of the anti-tragus, upon which it passes upwards and outwards to terminate upon the helix, crossing the fissure between it and the anti-tragus.

m. Tragicus (fig. 8, No. 12) consists of some fibres which are placed upon the tragus, extended from its base to its apex.

m. Transversus Auriculæ (fig. 9, No. 2) stretches from the convexity of the concha to that of the fossa innominata.

Musculus obliquus Auris (fig. 9, No. 3) extends from the dorsum of the concha to that of the scapha.

m. Contractor meatûs (trago-helicus ; fig. 8, No. 9 ; fig. 9, No. 5 ;) ascends from the tragus obliquely to the anterior extremity of the helix.

The internal muscles of the ear are very small; only four are usually enumerated, of which three are attached to the malleus.

The Internal muscle of the Malleus (m. internus mallei; tensor tympani; fig. 7, No. 6) arises from the upper surface of the cartilage of the Eustachian tube, and also from the contiguous

PLATE LI.

The larynx and its muscles are here shown ; also the muscles of the ear, and some of those of the mouth.

Fig. 1. Nos. 1, 1. The great or upper cornua of the thyroid cartilage. 2, 2. The alæ of the thyroid cartilage. 3. The cricoid cartilage. 4, 4. The crico-thyroid muscles.

Fig. 2. Nos. 1, 1. The great cornua of the thyroid cartilage. 2, 2. Its alæ. 3, 3. The arytænoid cartilages. 4. The arytænoideus muscle. 5, 5. The posterior borders of the alæ of the thyroid cartilage. 6. The middle ridge at the posterior aspect of the cricoid cartilage. 7, 7. The crico-arytænoideus posticus muscle. 8, 8. The inferior or smaller cornua of the thyroid cartilage. 9. The upper part of the trachea.

Fig. 3. A side view of the larynx and os hyoides is here given.

No. 1. The body of the os hyoides. 2. Its small cornua. 3. Its great cornu. 4. The thyro-hyoid membrane. 5. The great cornu of the thyroid cartilage. 6. Its ala. 7. The crico-thyroid muscle. 8. The cricoid cartilage.

Fig. 4. The ala of the thyroid cartilage is cut away at the right side, in order to bring into view the muscles in immediate apposition with the rima of the glottis.

No. 1. The great cornu of the thyroid cartilage. 2. The inner surface of its ala at the left side. 3. The surface of the incision made in order to remove the right ala. 4. The right arytænoid cartilage. 5. Part of the arytænoideus muscle. 6. The thyro-arytænoideus muscle. 7. The crico-arytænoideus lateralis muscle. 8. The crico-arytænoideus posticus muscle. 9. The right side of the cricoid cartilage. 10. The first ring of the trachea.

Fig. 5. The larynx is laid open at the back part, so as to expose its interior.

Nos. 1, 1. The small cornua of the os hyoides. 2, 2. The inner surface of the thyro-hyoid membrane. 3. The epiglottis. 4, 4. The arytænoid cartilages. 5, 5. The ventricles of the larynx. 6, 6. The lower or true cordæ vocales. 7, 7. The cut edges of the cricoid cartilage, divided by a vertical incision in the middle, and held apart. 8. The upper rings of the trachea.

Fig. 6. The temporal bone of the right side, the external meatus of the ear, and the membrana tympani, being cut away in order to show the chain of bones in the tympanum, and one of the muscles.

No. 1. The squamous part of the temporal bone. 2. Its zygomatic process. 3. The anterior root of this process. 4. The posterior one. 5. The mastoid process. 6. Part of the osseous lamella, forming the part of the glenoid fossa behind the fissura Glasseri. 7. The incus, 8. The stapes. 9. The malleus; being the three small bones of the ear. 10. The anterior muscle of the malleus (m. anterior mallei, or laxator tympani).

Fig. 7. An inner view of the tympanum and ossicula auditûs.

No. 1. The squamous part of the temporal bone; its inner surface. 2. The malleus. 3. The incus. 4. The stapes. 5. The stapedius muscle. 6. The internal muscle of the malleus (m. internus mallei, or tensor tympani).

Fig. 8. The external ear and its muscles.

No. 1. The elevator muscle (m. attollens aurem). 2, 2. The helix. 3. The fossa innominata. 4, 4. The two limbs or branches of the anti-helix. 5. The fossa navicularis. 6. The greater muscle of the helix (m. major helicis). 7. The anterior muscle of the ear (m. attrahens aurem). 8. The smaller muscle of the helix (m. minor helicis). 9. The contractor meatûs muscle. 10. The anti-helix. 11. The tragus. 12. The tragicus muscle. 13, 14. The lobule of the ear. 15. The anti-tragicus muscle. 16. The retrahens aurem muscle.

Fig. 9. No. 1. The helix. 2. The transversus auris muscle. 3. The obliquus auris muscle. 4. Some fibres of the muscles of the helix (major and minor). 5. The contractor meatûs muscle. 6. The tragicus muscle. 7. The tragus. 8. The anti-tragus, seen at the back part. 9, 9. The retrahens aurem muscle. 10. The lobule of the ear.

Fig. 10. Nos. 1, 1. The ears. 2, 2. The lips, divided and drawn back. 3, 3. The mucous lining of the cheeks. 4. The hard palate. 5. The uvula, hanging down from the soft palate. 6, 6. The palato-glossus muscle at each side (m. constrictor isthmi faucium). 7, 7. The palato-pharyngeus muscle at each side. 8, 8. The tonsils. 9, 9. The depressor muscle of the upper lip (m. depressor labii superioris alæque nasi). 10, 10. The elevator muscle of the lower lip (m. levator labii inferioris).

border of the pars petrosa of the temporal bone; it inclines outwards and backwards in the osseous canal that runs parallel with the Eustachian tube, and becomes tendinous on entering the tympanum, where it is inserted into the short process of the malleus.

The Anterior muscle of the Malleus (m. anterior mallei, laxator tympani major; fig. 6, No. 10,) arises from the spinous process of the sphenoid bone, and soon becoming tendinous, passes through the glenoid fissure to be inserted into the processus gracilis of the malleus.

The External muscle of the Malleus (m. externus mallei, laxator tympani minor) is very small, and so indistinct, that many anatomists have omitted it altogether; it arises from the upper border of the osseous part of the auditory tube, and descends to be inserted into the manubrium of the malleus, near its short process.

The muscle of the Stapes (m. stapedius; fig. 7, No. 5;) arises from a deep sulcus at the back part of the tympanum, and runs forwards tapering to its termination, which is fixed to the neck of the stapes.

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